



**Ryan Harvey, MD**

Clinical Assistant Professor, FSU College of  
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Chair, Radiology, Sarasota Memorial Hospital

President, Radiology Associates of Florida

**RADIOLOGY**

*For the Internal Medicine  
Physician*

- 
- Intro to CT
  - CT and XR Cases

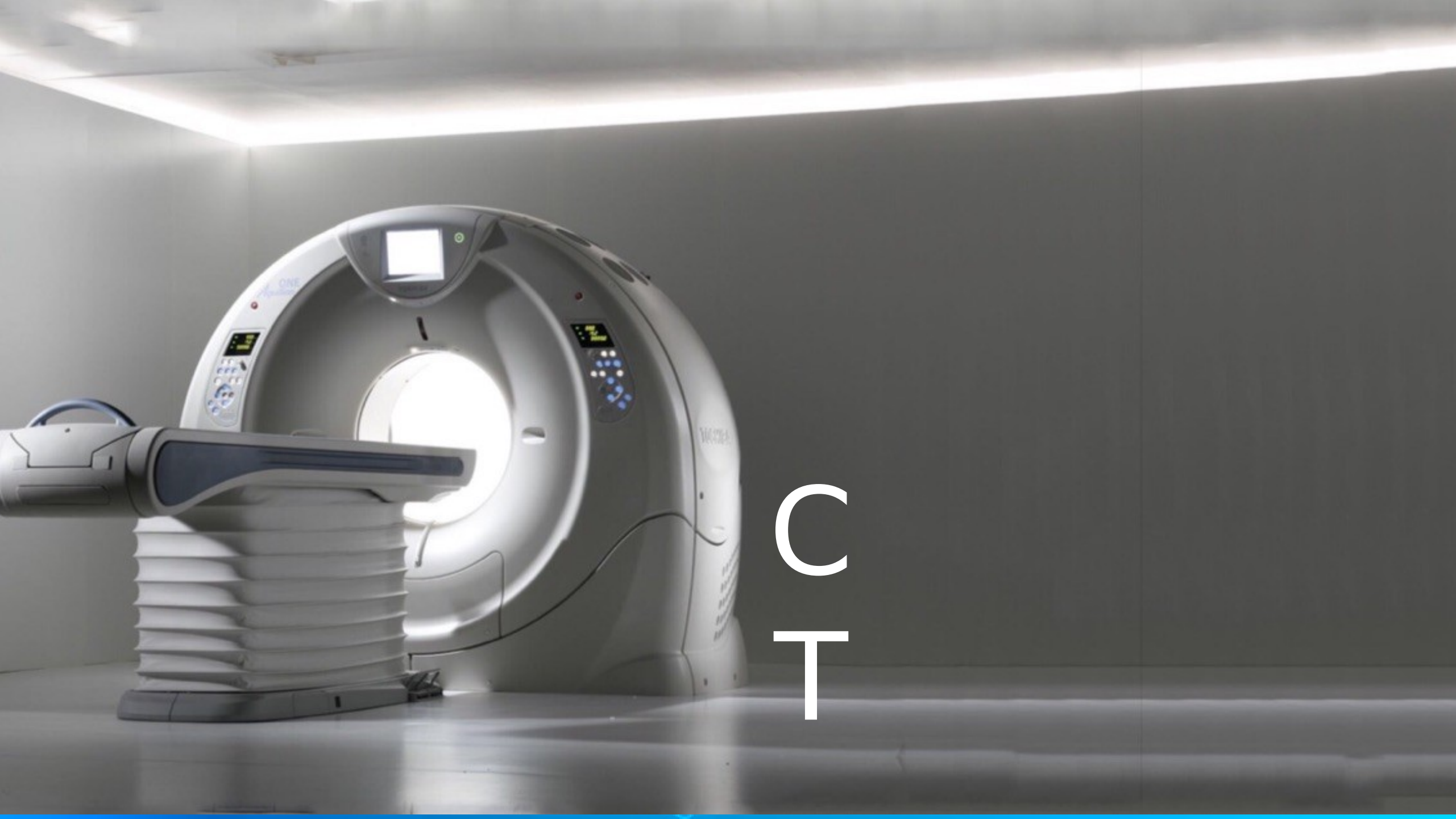
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**RADIOLOGY**

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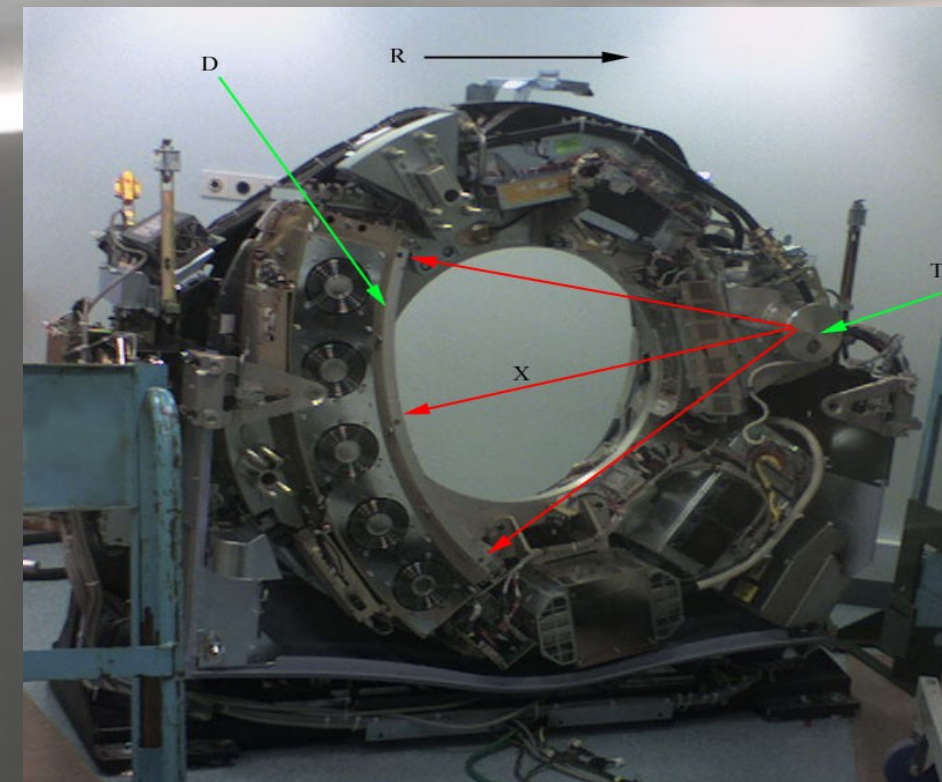


CT

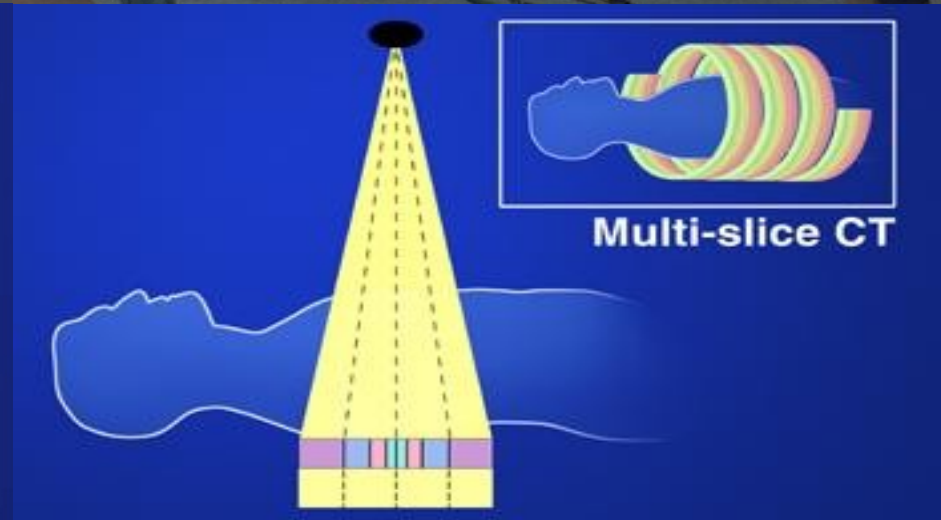
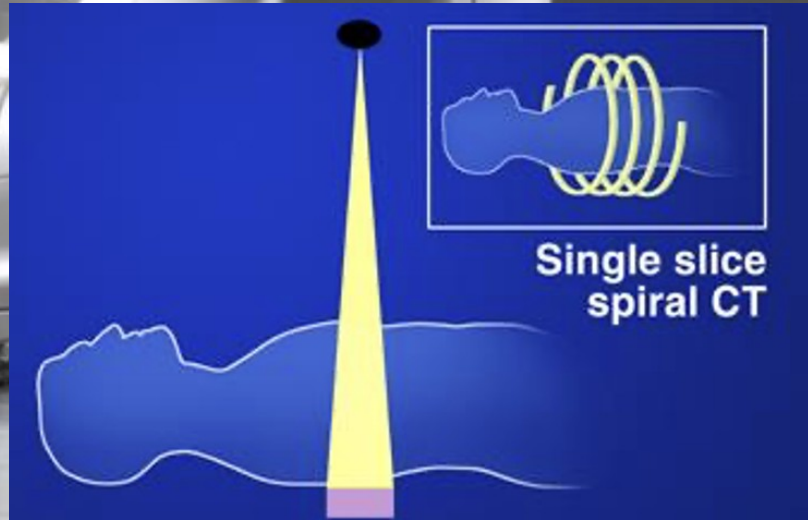
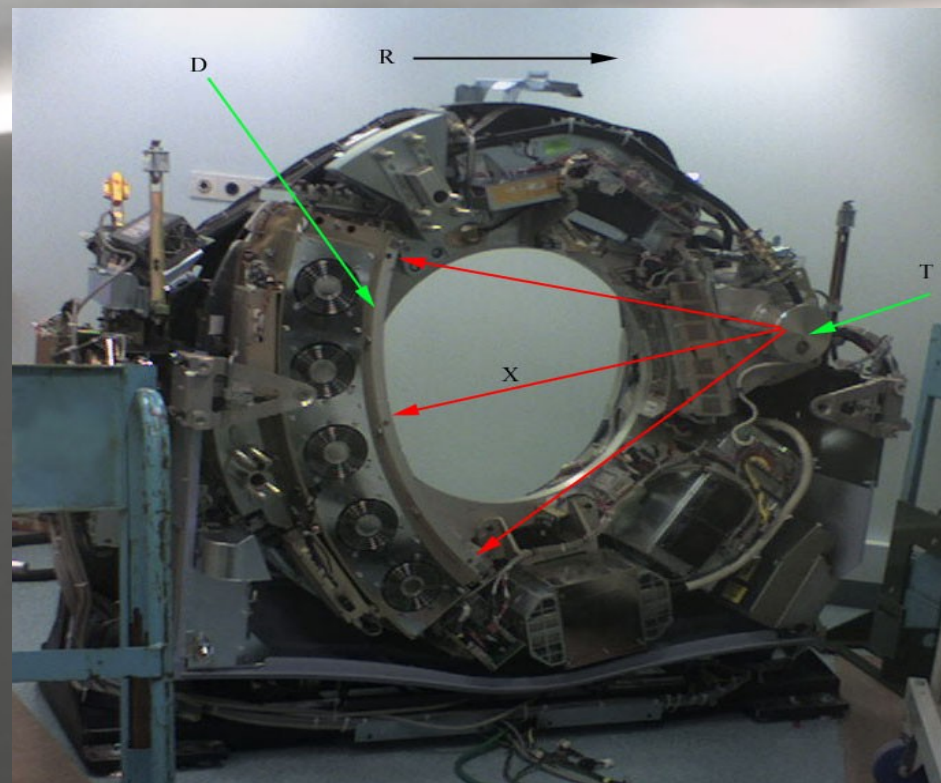
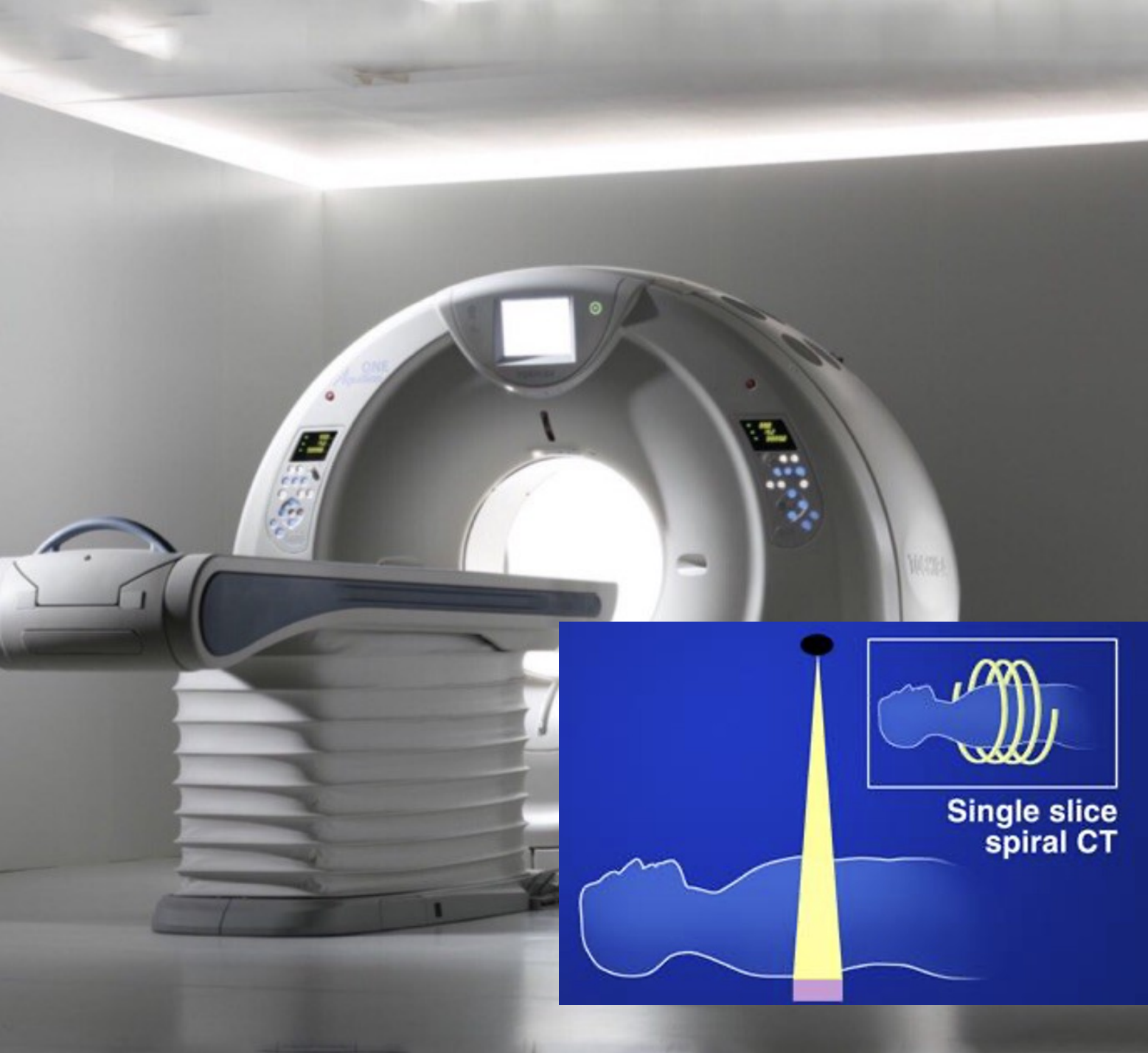




CT





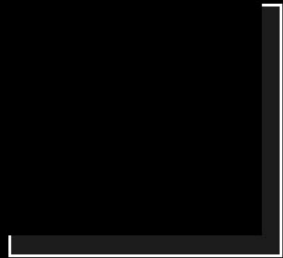




# Computed Tomography : Concepts

- **Density**

Hounsfield Units



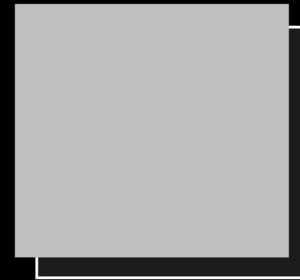
**Air (-1000 H)**



**Fat (-100 H)**



**Water (0 H)**



**Blood (40 H)**



**Bone (1000 H)**



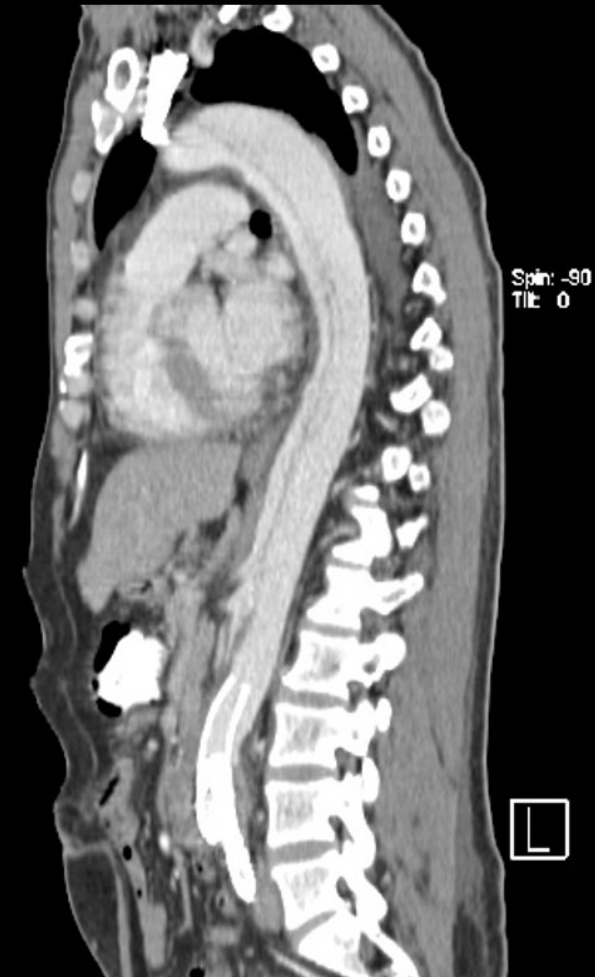
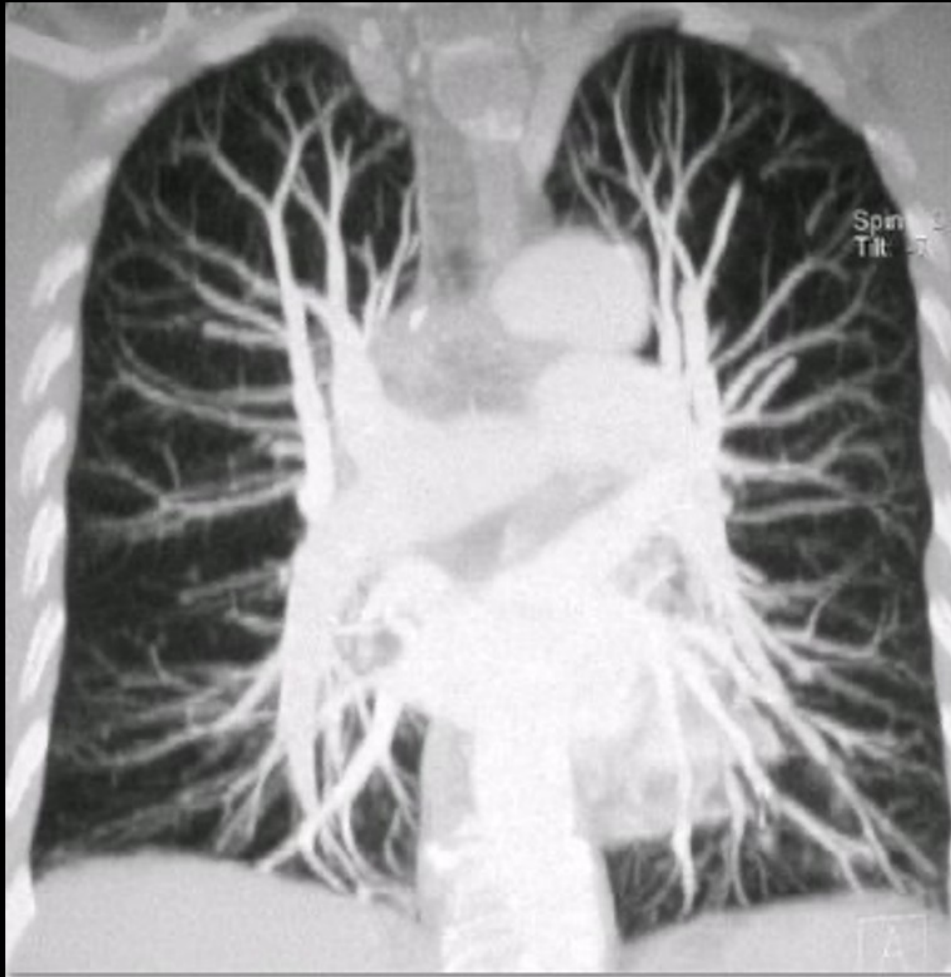
# Computed Tomography : Concepts

Radio-opaque contrast enhances images



# Computed Tomography : Concepts

CT Images can be reconstructed in any plane

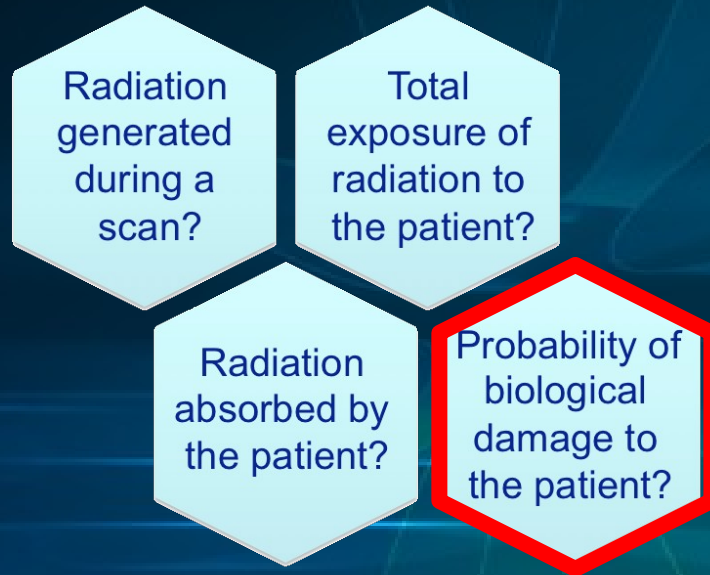


The background of the slide features a large, glowing blue radiation symbol (a stylized atomic symbol) centered on the left side. To the right of the symbol, there is a vertical, glowing blue image of a human arm, showing the skeletal structure, positioned as if it is being scanned or is the subject of radiation. The overall color scheme is dark blue and black, with bright blue highlights from the glowing elements.

# CT Radiation Safety



# How Do We Talk About Radiation Dose?



1 mSv

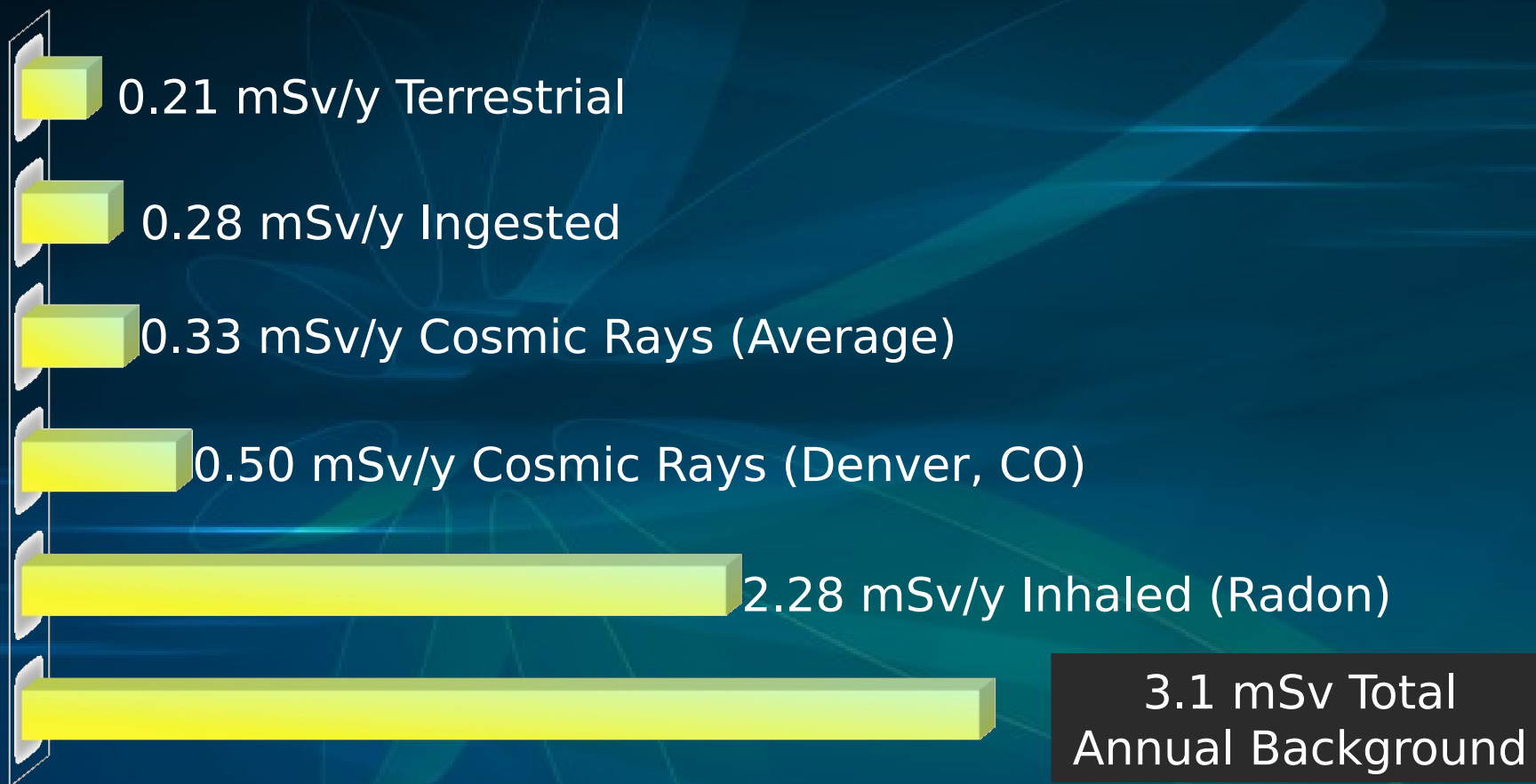
≈

1 / 10,000 risk of cancer  
diagnosis

1 / 20,000 risk of cancer  
mortality  
(Baseline lifetime cancer incidence: 40%)

Effective Dose  
(Sievert, mSV)

# Everyday Dose Estimates



# Radiography

<b>Radiograph:</b>	<b>Dose (mSv)</b>	<b>BRE*</b>
<b>Extremity</b>	0.001	3 hours
<b>CXR</b>	0.1	10 days
<b>Mammography</b>	0.4	7 weeks
<b>DEXA</b>	< 0.001	Negligible
<b>Spine</b>	1.5	6 months
<b>UGI Fluoroscopy</b>	6	2 years
<b>Barium Enema Fluoroscopy</b>	8	3 years

**BRE = Background Radiation Equivalent**





# CT

<b>CT:</b>	<b>Dose (mSv)</b>	<b>BRE</b>
<b>CT A/P</b>	10	3 years
<b>CT A/P w/ and w/o</b>	20	7 years
<b>CT Head</b>	2	8 months
<b>CT Chest</b>	7	2 years
<b>CT Chest Screening</b>	1.5	6 months
<b>CTA Coronary</b>	12	4 years
<b>CT Calcium Score</b>	3	1 year

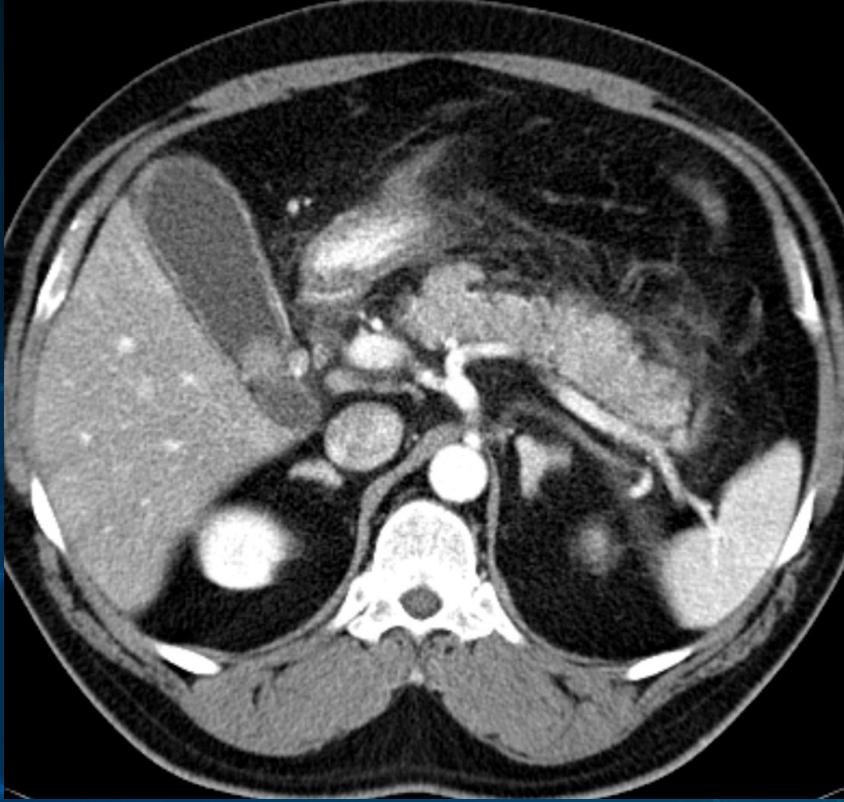




*“Diagnosis  
by density  
difference”*

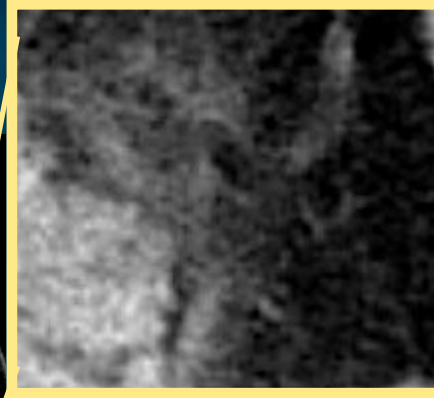
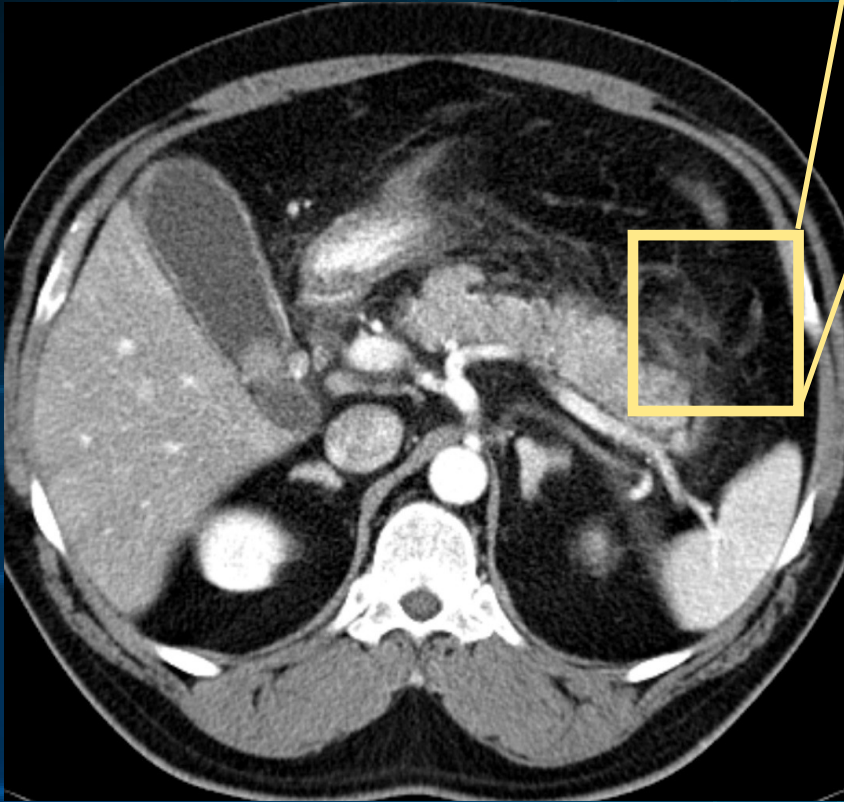
CT Concepts

# CT Concepts: Stranding





# CT Concepts: Stranding

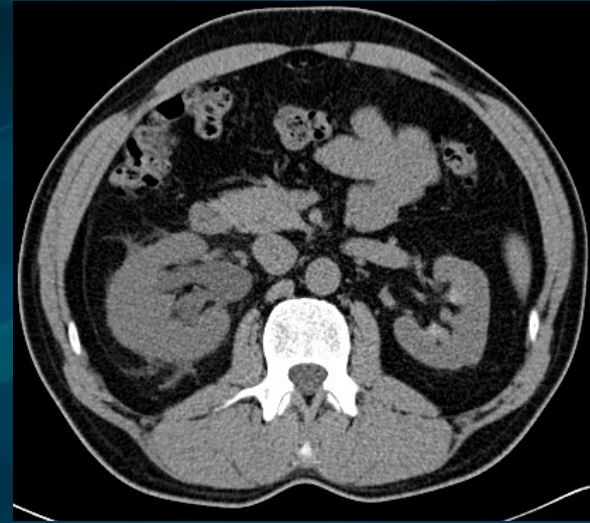
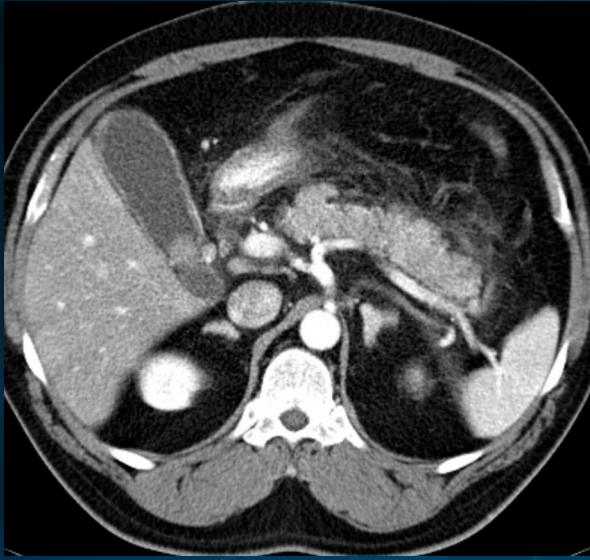


## **Fluid stranding**

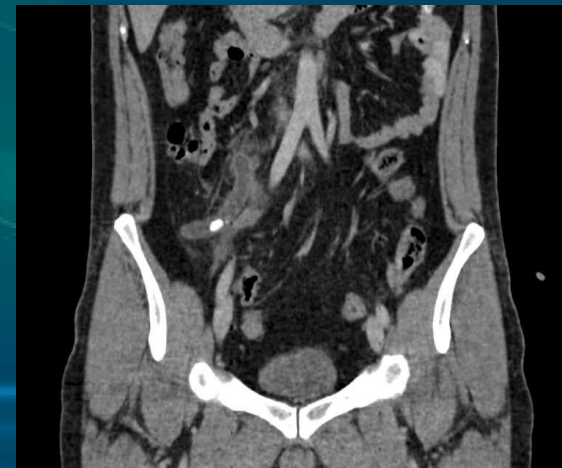
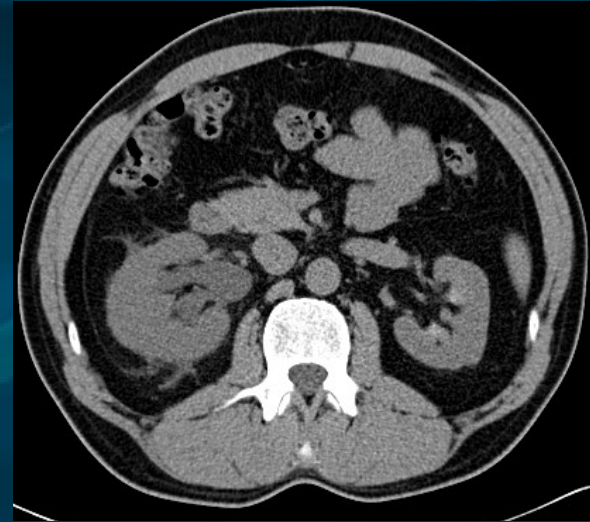
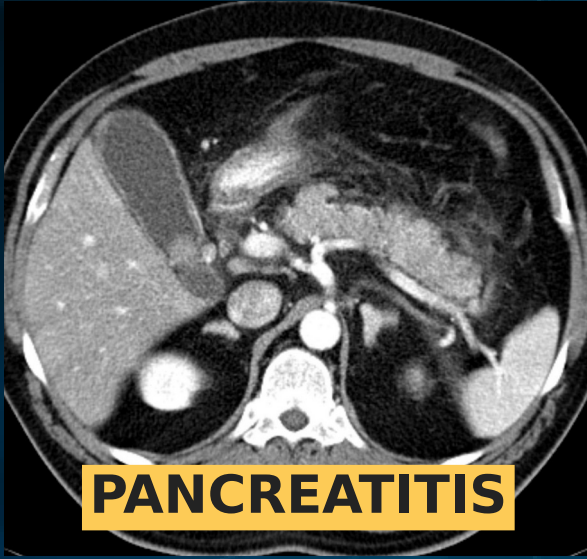
**Inflammation or edema causes “fluid stranding” in surrounding soft tissues**

**Infiltrating band-like or reticular opacities**

# CT Concepts: Stranding

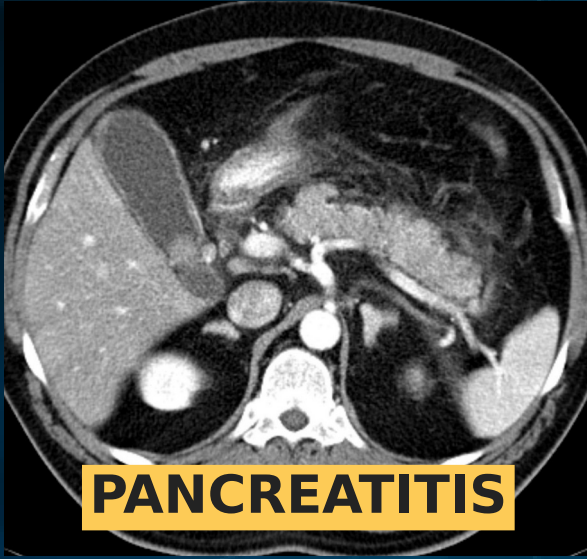


# CT Concepts: Stranding

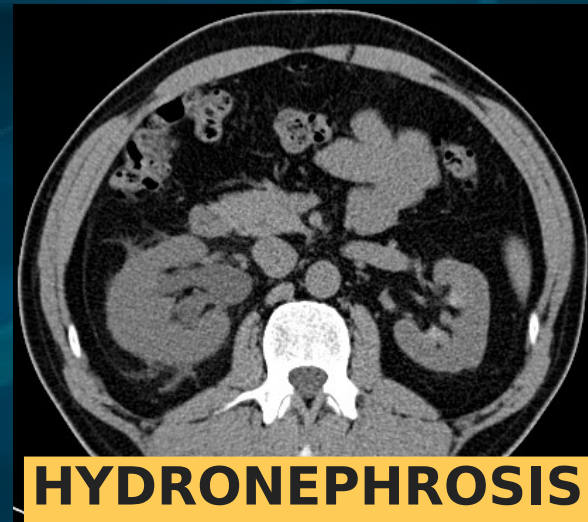




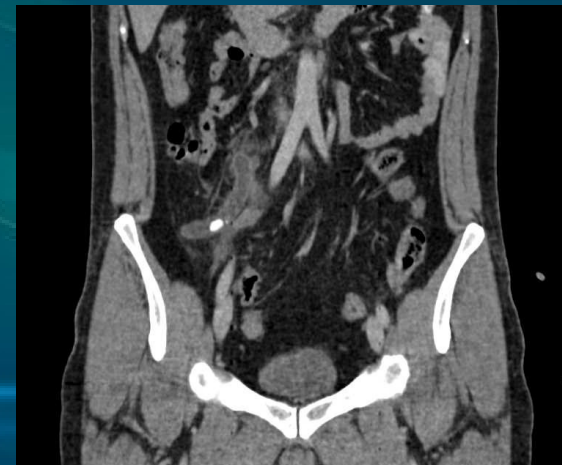
# CT Concepts: Stranding



**PANCREATITIS**

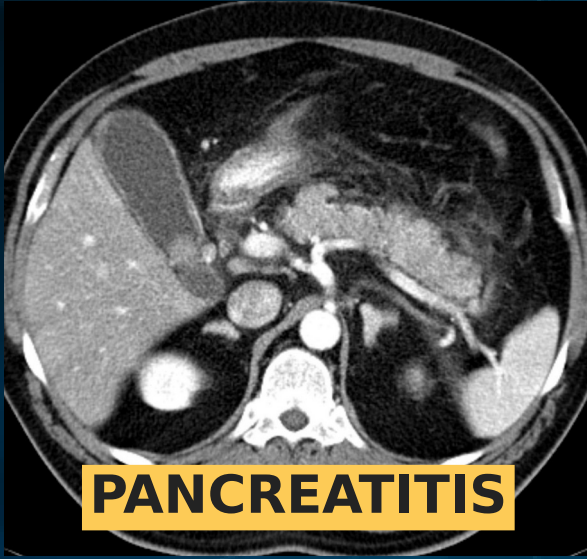


**HYDRONEPHROSIS**

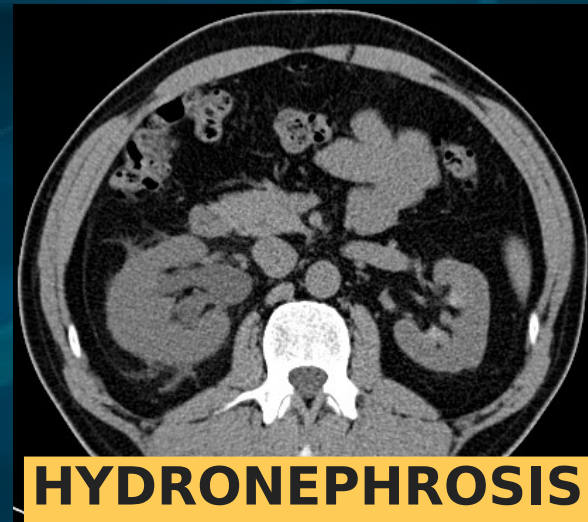




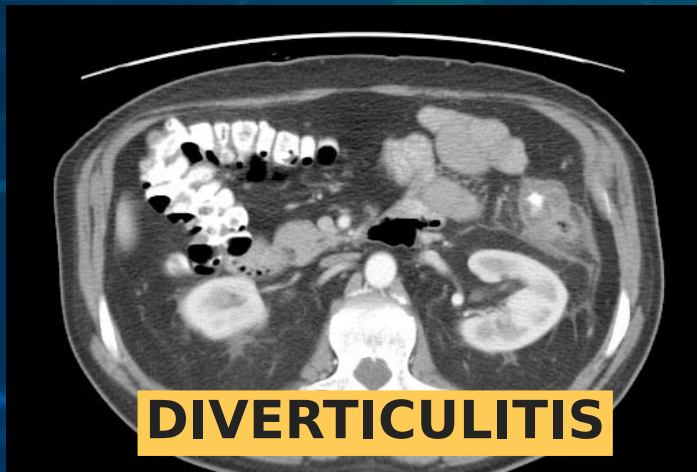
# CT Concepts: Stranding



**PANCREATITIS**



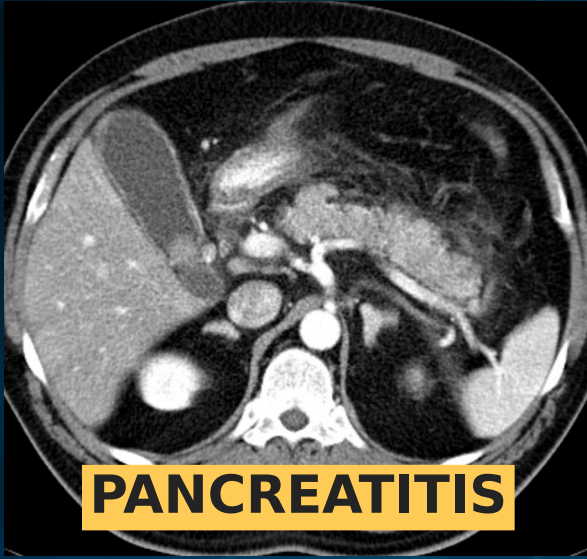
**HYDRONEPHROSIS**



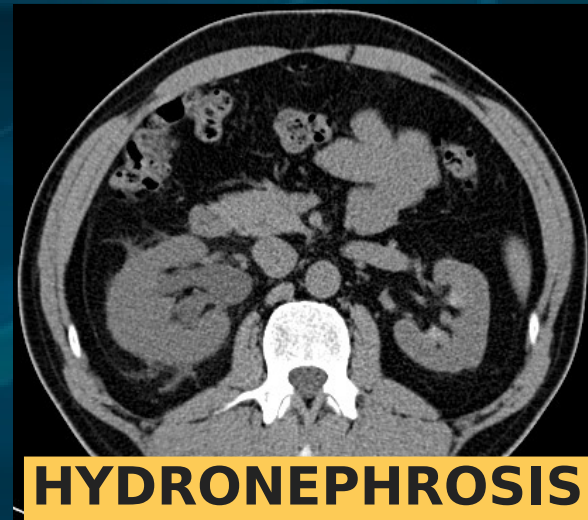
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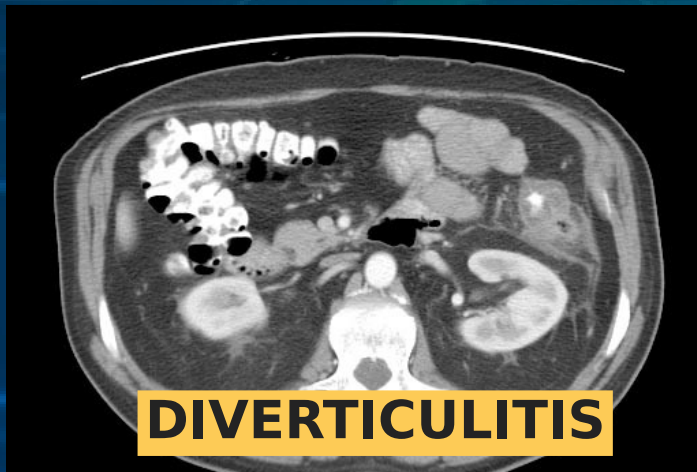
# CT Concepts: Stranding



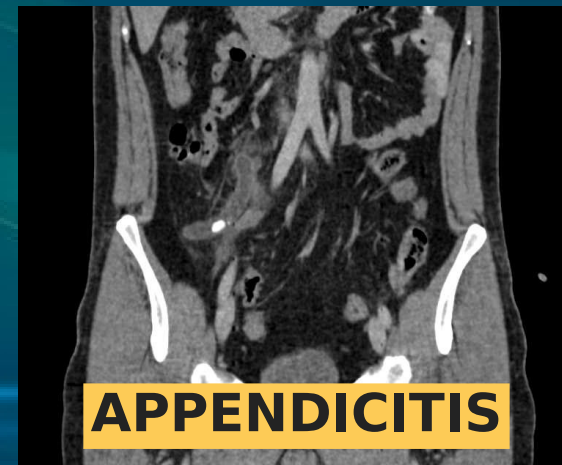
**PANCREATITIS**



**HYDRONEPHROSIS**

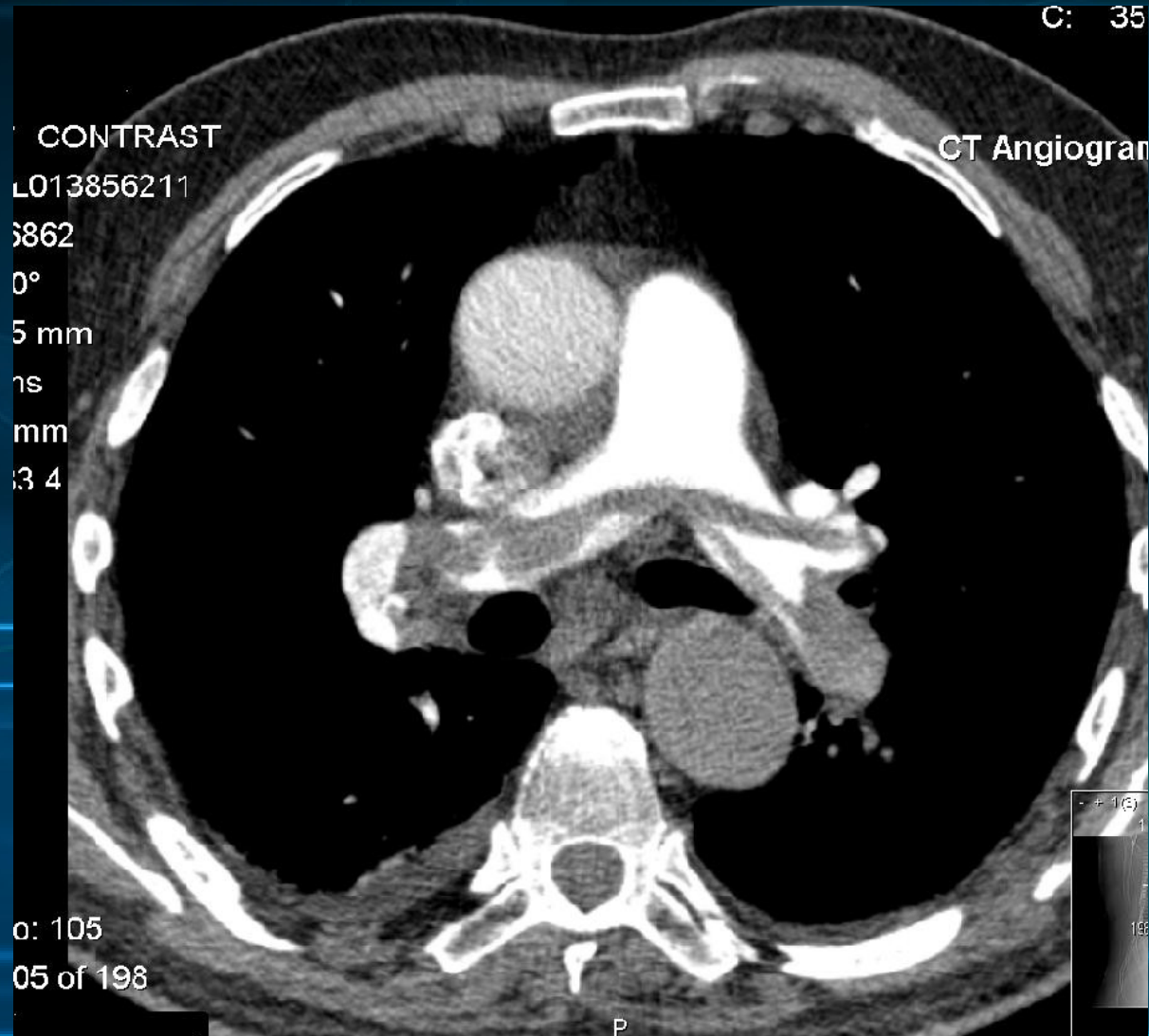


**DIVERTICULITIS**



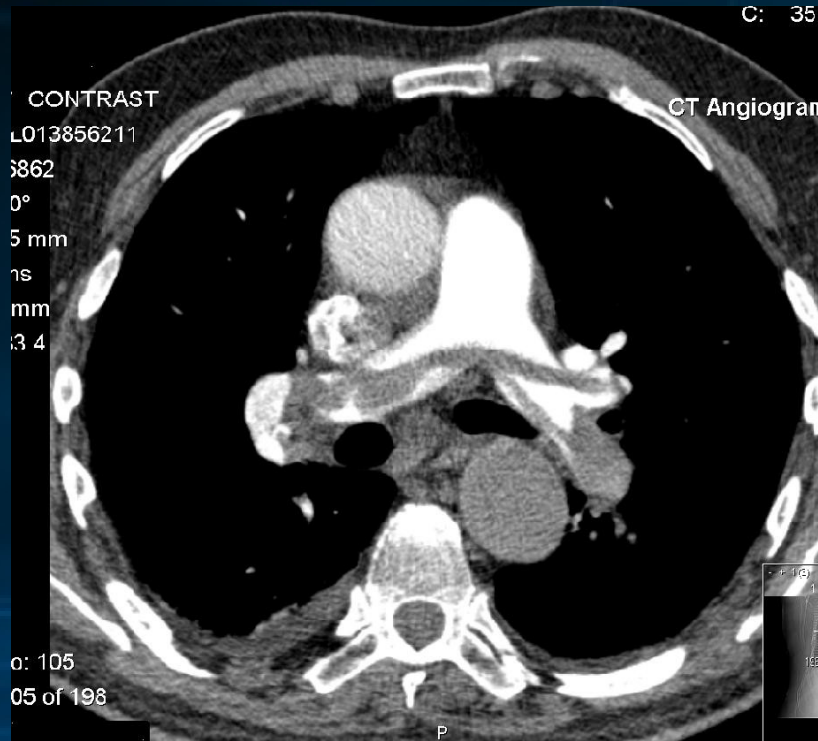
**APPENDICITIS**

# CT Concepts:



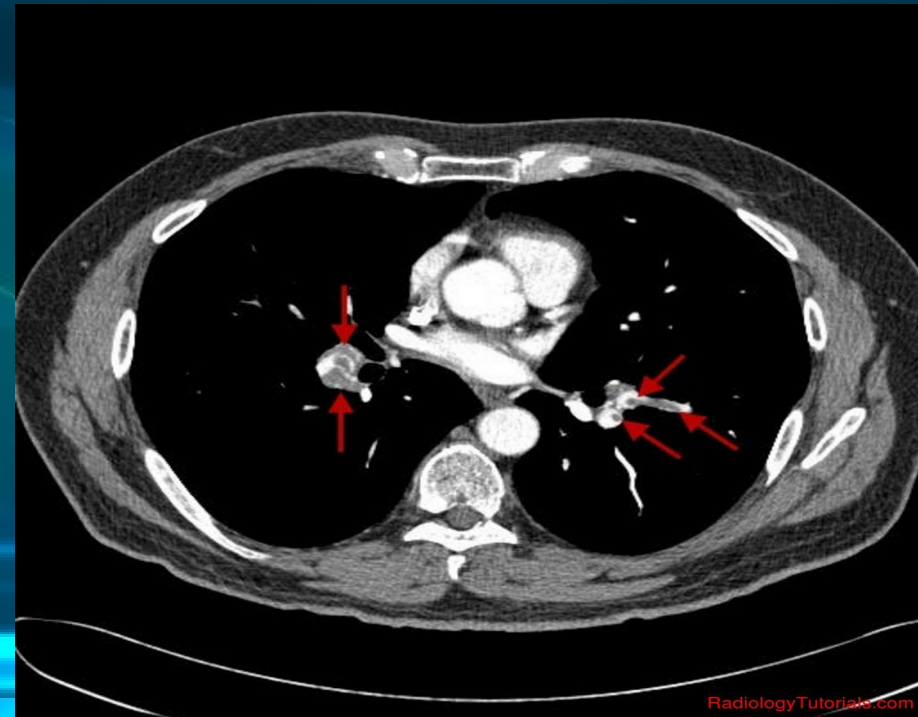


# CT Concepts: Pulmonary embolism



## Pulmonary embolism

Central filling defects  
on CT pulmonary  
angiography





# CT Concepts:



# CT Concepts: Intracranial hemorrhage

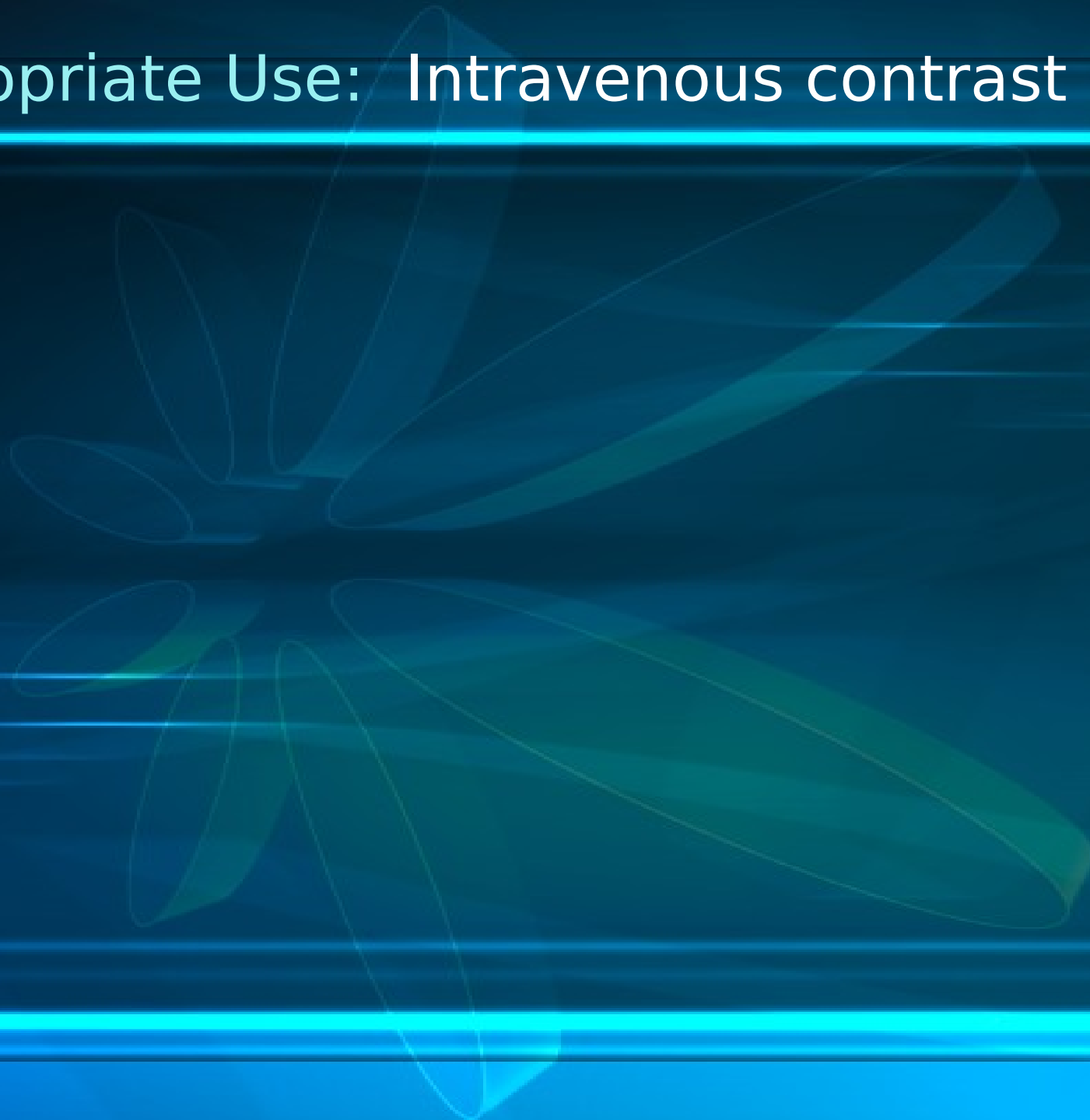


**Epidural hematoma**  
Lenticular shape



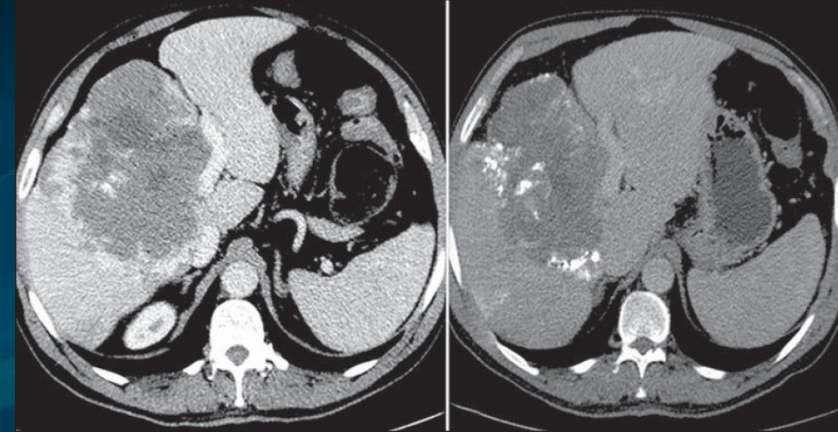
**Subdural hematoma**  
Crescent shaped

Appropriate Use: Intravenous contrast



# Appropriate Use: Intravenous contrast

Unindicated multiphase CT scans contribute to unnecessary radiation exposure<sup>18</sup>



CT A/P	Dose Estimate <sup>19</sup> (mSv)
Single phase of contrast	Up to 14
With and without contrast	Up to 28
Triple phase	Up to 42
Quadruple phase	Up to 56



# Appropriate Use: Intravenous contrast

Clinical scenarios that only require a single post-contrast CT acquisition:

**Appendicitis**

**Diverticulitis**

**Cholecystitis**

**Inflammatory bowel disease**

**Small bowel obstruction**

**Hypovascular malignancy**

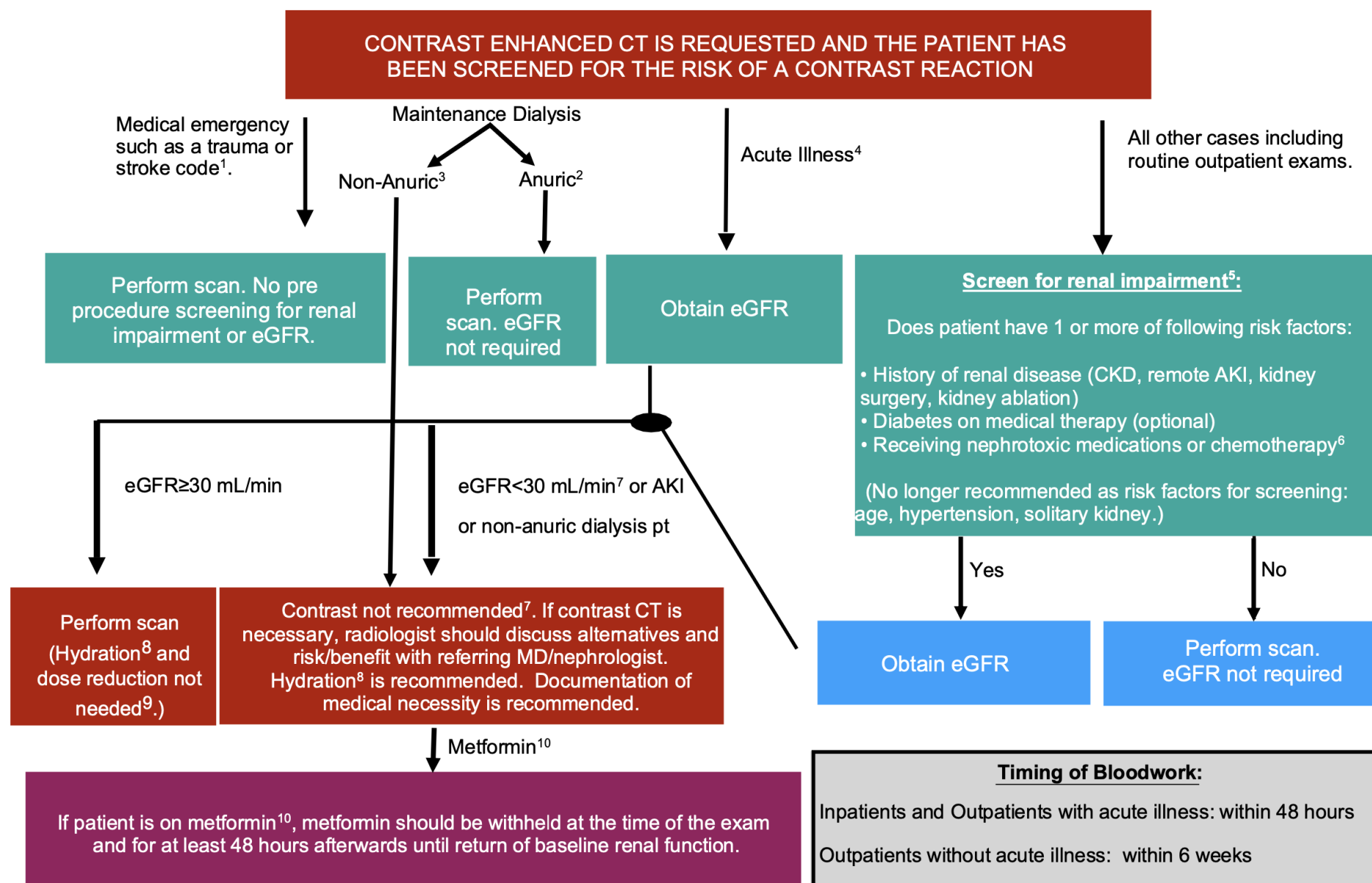
**(lung, gastric, colorectal, GIST, ovary, sarcoma, lymphoma, breast)**

# Appropriate Use: Intravenous contrast

Clinical scenarios that require multiple CT acquisitions:

<b>Pancreatic cancer</b>	<b>(arterial and venous)</b>
<b>Hepatocellular carcinoma</b>	<b>(arterial and venous)</b>
<b>Hypervascular malignancies</b>	<b>(arterial and venous)</b>
<b>Ischemic bowel</b>	<b>(arterial and venous)</b>
<b>GI hemorrhage</b>	<b>(arterial and venous)</b>
<b>Adrenal nodule</b>	<b>(noncontrast, venous, 15-minute)</b>
<b>Aortic endograft</b>	<b>(noncontrast, arterial, venous)</b>
<b>Cholangiocarcinoma</b>	<b>(arterial, venous, delay)</b>
<b>Hematuria or renal mass</b>	<b>(noncontrast, arterial, venous, delay)</b>

# Contrast and Renal Failure



# Key points

GFR threshold of 30 for CT IV contrast

Anuric dialysis patients can receive CT IV contrast

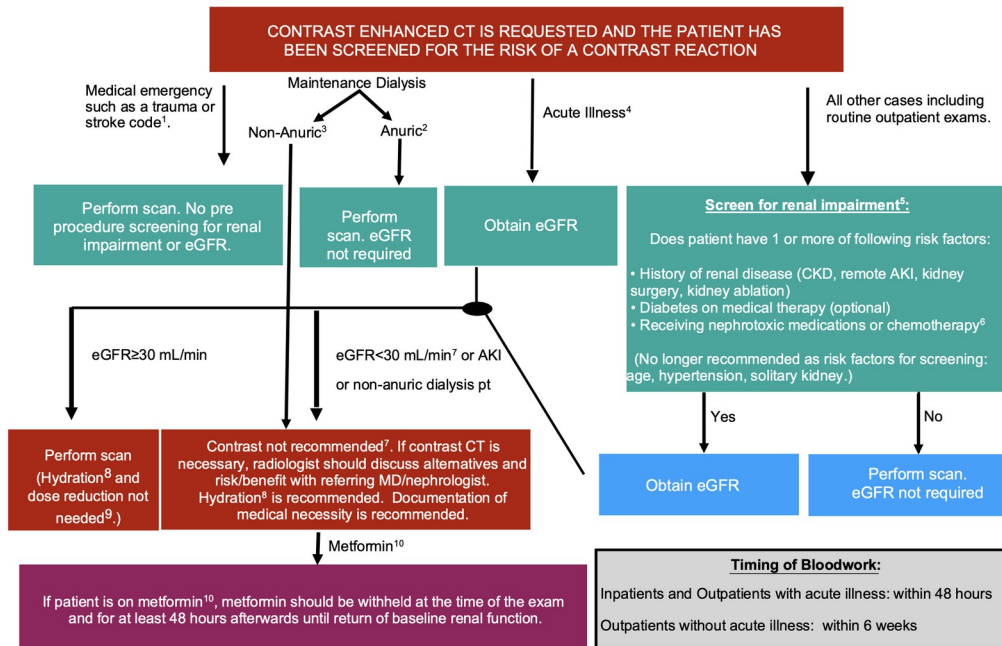
Non-anuric dialysis patients should not receive CT IV contrast

Outpatients without renal disease, diabetes or nephrotoxic meds do not require routine renal function screening prior to CT IV contrast

To prevent contrast associated nephropathy in susceptible patients, hydration is the preferred intervention

CVT Dec 2021

## RP STATEMENT ON IODINATED CONTRAST MEDIA FOR CT AND RENAL IMPAIRMENT





# Contrast Reactions

## Mild

### Allergic-like

Limited urticaria / pruritis

Cutaneous Edema

Limited “itchy”/“scratchy” throat

Nasal congestion

Sneezing / conjunctivitis / rhinorrhea

### Physiologic

Limited nausea / vomiting limited

Transient flushing / warmth / chills

Headache / dizziness / anxiety / altered taste

Mild hypertension

Vasovagal reaction that resolves spontaneously

## Severe

### Allergic-like

Diffuse edema, or facial edema with dyspnea

Diffuse erythema with hypotension

Laryngeal edema with stridor and/or hypoxia

Wheezing / bronchospasm, significant hypoxia

Anaphylactic shock (hypotension + tachycardia)

### Physiologic

Vasovagal reaction resistant to treatment

Arrhythmia

Convulsions, seizures

Hypertensive emergency

# Contrast Reactions: Prevention

## Contrast Premedication for Allergy

➤ Two frequently used regimens are:

- 1. Oral
  - 50 mg prednisone by mouth at 13 hours, 7 hours, and 1 hour before contrast media injection, plus
  - Diphenhydramine (Benadryl®) – 50 mg intravenously, intramuscularly, or by mouth 1 hour before contrast medium [12].
- 2. Intravenous “stat” prep -- not preferred
  - IV methylprednisolone, benadryl – check with institution for exact protocol timing

# Fast Reactions: Treatment

Observation

Benadryl

Epinephrine (IM)

Epinephrine (IV)

Mild



Severe

# Appropriate Use: Scenarios

Scenario	Best Examination
Acute head trauma	
Biliary colic	
COPD exacerbation	
RLQ pain	
Renal colic	
Osteomyelitis	
Whole-body cancer staging	



# Appropriate Use: Scenarios

Scenario	Best Examination
Acute head trauma	CT head w/o contrast
Biliary colic	
COPD exacerbation	
RLQ pain	
Renal colic	
Osteomyelitis	
Whole-body cancer staging	

# Appropriate Use: Scenarios

Scenario	Best Examination
Acute head trauma	CT head w/o contrast
Biliary colic	RUQ ultrasound
COPD exacerbation	
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Renal colic	
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Whole-body cancer staging	

# Appropriate Use: Scenarios

Scenario	Best Examination
Acute head trauma	CT head w/o contrast
Biliary colic	RUQ ultrasound
COPD exacerbation	CXR
RLQ pain	
Renal colic	
Osteomyelitis	
Whole-body cancer staging	

# Appropriate Use: Scenarios

Scenario	Best Examination
Acute head trauma	CT head w/o contrast
Biliary colic	RUQ ultrasound
COPD exacerbation	CXR
RLQ pain	CT A/P w/ contrast
Renal colic	
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Whole-body cancer staging	



# Appropriate Use: Scenarios

Scenario	Best Examination
Acute head trauma	CT head w/o contrast
Biliary colic	RUQ ultrasound
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# Appropriate Use: Scenarios

Scenario	Best Examination
Acute head trauma	CT head w/o contrast
Biliary colic	RUQ ultrasound
COPD exacerbation	CXR
RLQ pain	CT A/P w/ contrast
Renal colic	CT A/P w/o contrast
Osteomyelitis	MRI w/ and w/o contrast
Whole-body cancer staging	

# Appropriate Use: Scenarios

Scenario	Best Examination
Acute head trauma	CT head w/o contrast
Biliary colic	RUQ ultrasound
COPD exacerbation	CXR
RLQ pain	CT A/P w/ contrast
Renal colic	CT A/P w/o contrast
Osteomyelitis	MRI w/ and w/o contrast
Whole-body cancer staging	PET/CT scan

# CT: Uses Overview



**Acute headache /  
trauma**

**Stroke**

**Spine / ortho trauma**

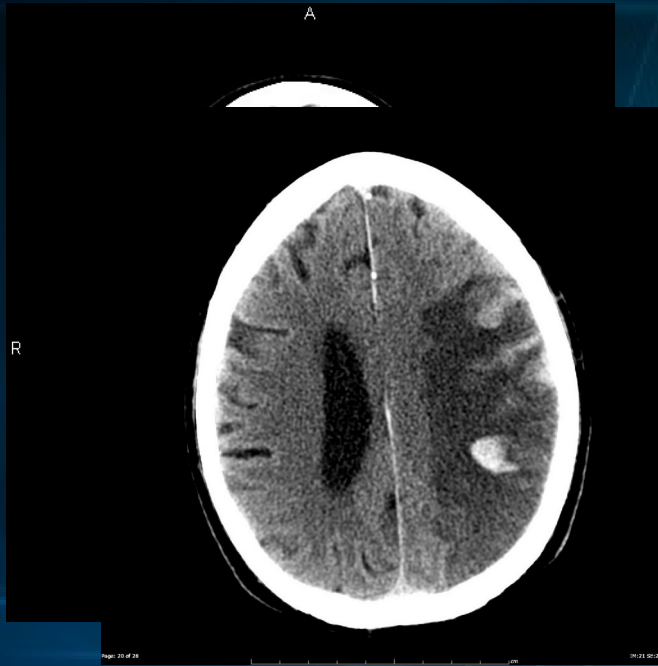
**Chest pain**

**Diffuse lung disease**

**Abdominal pain**



# CT: Uses Overview



Acute headache /  
trauma  
**Stroke**

# CT: Uses Overview



**Acute headache /  
trauma**

**Stroke**

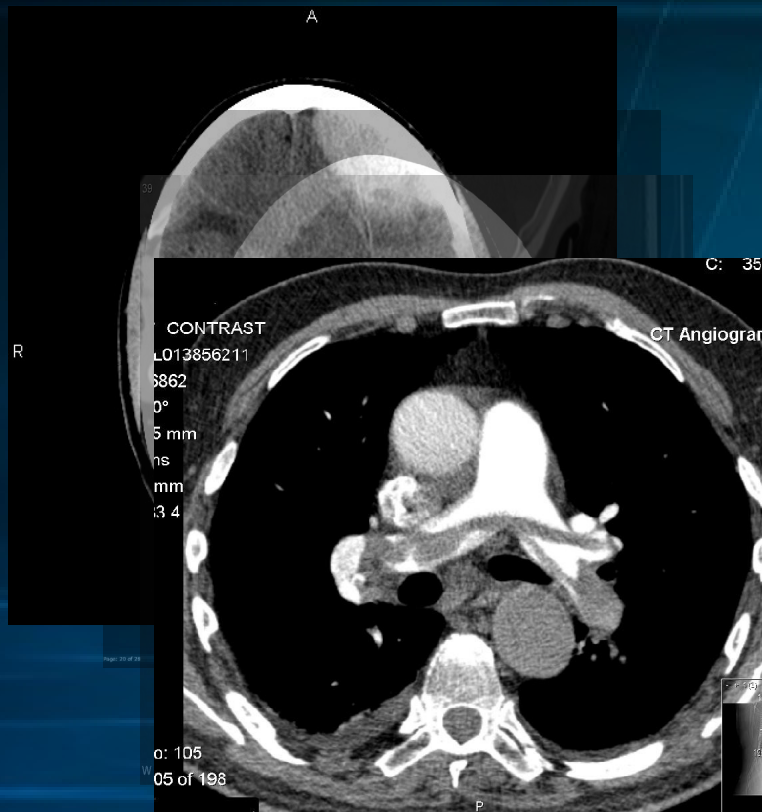
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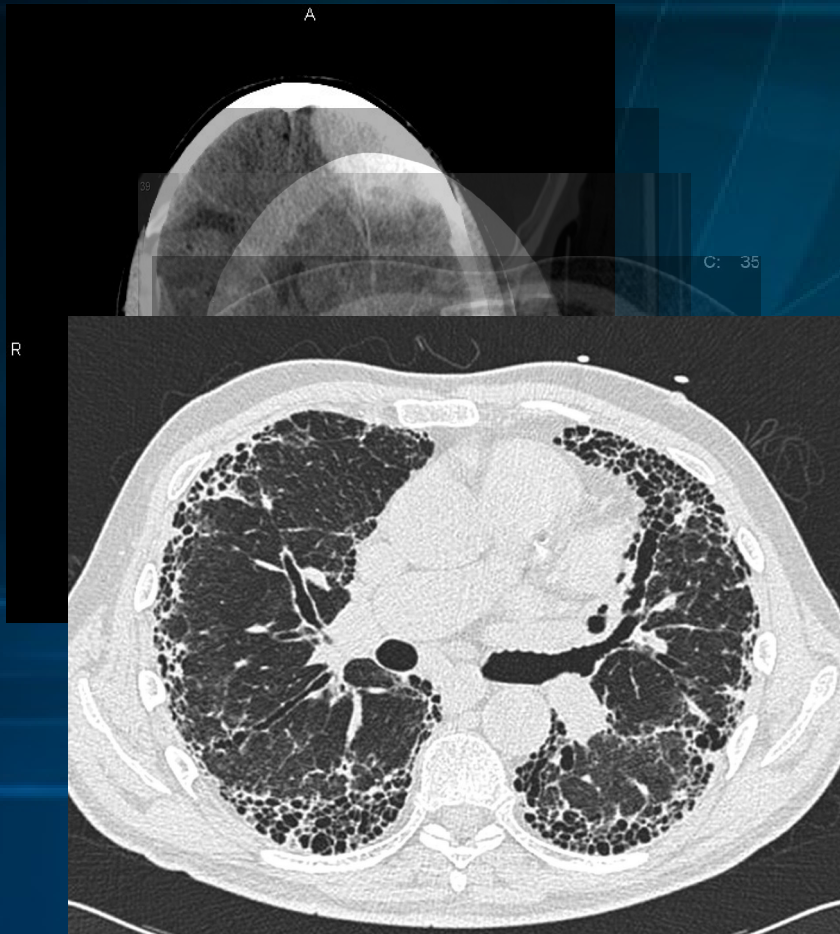
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# CT: Uses Overview



**Acute headache /  
trauma**

**Stroke**

**Spine / ortho trauma**

**Chest pain**

**Diffuse lung disease**

**Abdominal pain**



# SCENARIOS





# SCENARIO: Screening for Lung Cancer

Who to screen?

# SCENARIO: Screening for Lung Cancer

## Who to screen?

Current or Former  
Smokers with at  
least a 20 pack-year  
history

# SCENARIO: Screening for Lung Cancer

How to screen?

XR   CT   MRI   PET  
Labs



# SCENARIO: Screening for Lung Cancer

How to screen?

XR   CT   MRI   PET  
Labs

# SCENARIO: Screening for Lung Cancer

## How to screen?

**American College of Radiology  
ACR Appropriateness Criteria®  
Lung Cancer Screening**

**Variant 1:**

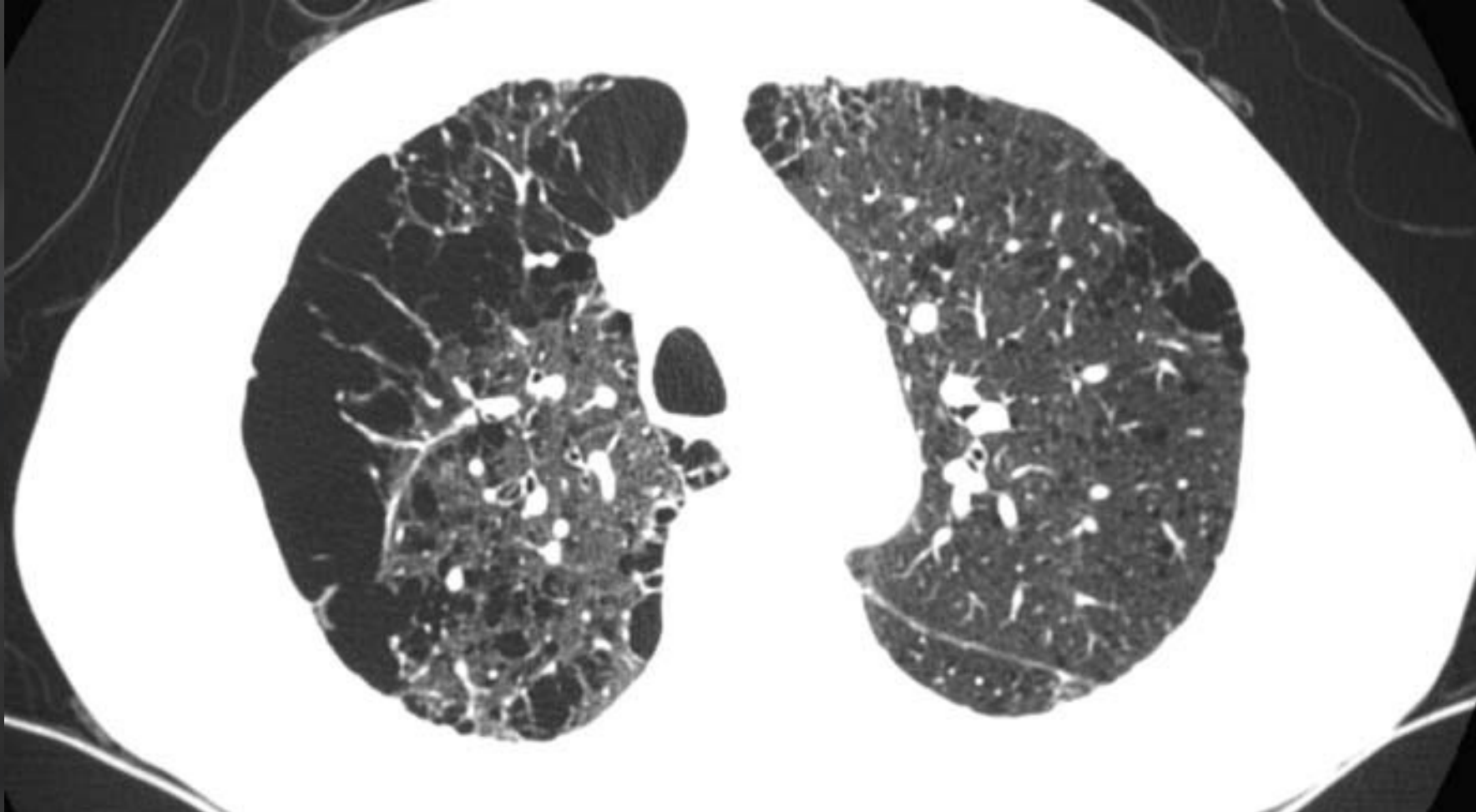
**Lung cancer screening. Patient 50 to 80 years of age and 20 or more packs per year smoking history and currently smoke or have quit within the past 15 years. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
CT chest without IV contrast screening	Usually Appropriate	⚙️⚙️⚙️
Radiography chest	Usually Not Appropriate	⚙️
MRI chest without and with IV contrast	Usually Not Appropriate	○
MRI chest without IV contrast	Usually Not Appropriate	○
CT chest with IV contrast	Usually Not Appropriate	⚙️⚙️⚙️
CT chest without and with IV contrast	Usually Not Appropriate	⚙️⚙️⚙️
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⚙️⚙️⚙️⚙️

# SCENARIO: Screening for Lung Cancer

<b>CT:</b>	<b>Dose (mSv)</b>	<b>BRE</b>
<b>CT A/P</b>	10	3 years
<b>CT A/P w/ and w/o</b>	20	7 years
<b>CT Head</b>	2	8 months
<b>CT Chest</b>	7	2 years
<b>CT Chest Screening</b>	1.5	6 months
<b>CTA Coronary</b>	12	4 years
<b>CT Calcium Score</b>	3	1 year

# SCENARIO: Screening for Lung Cancer





# SCENARIO: Screening for Colon Cancer

## Colonoscopy or CT Colonography?

No direct evidence evaluating the effect of SBMA FFI on colorectal cancer mortality

### Direct visualization tests

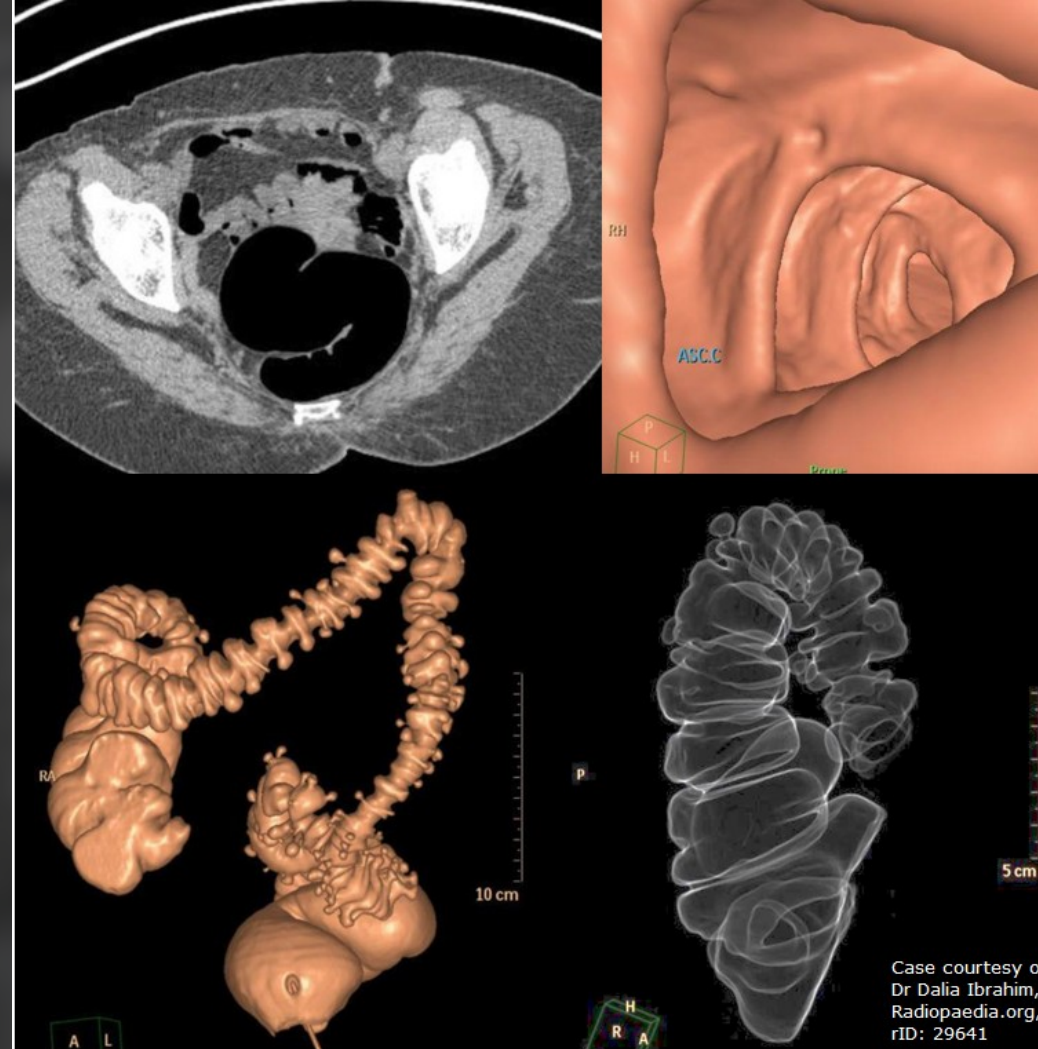
Colonoscopy	Every 10 y	<ul style="list-style-type: none"><li>• Evidence from cohort studies that colonoscopy reduces colorectal cancer mortality</li><li>• Harms from colonoscopy include bleeding and perforation, which both increase with age</li></ul>	<ul style="list-style-type: none"><li>• Screening and follow-up of positive results can be performed during the same examination</li><li>• Requires less frequent screening</li><li>• Requires bowel preparation, anesthesia or sedation, and transportation to and from the screening examination</li></ul>
CT colonography	Every 5 y	<ul style="list-style-type: none"><li>• Evidence available that CT colonography has reasonable accuracy to detect colorectal cancer and adenomas</li><li>• No direct evidence evaluating effect of CT colonography on colorectal cancer mortality</li><li>• Limited evidence about the potential benefits or harms of possible evaluation and treatment of incidental extracolonic findings, which are common. Extracolonic findings detected in 1.3% to 11.4% of examinations; &lt;3% required medical or surgical treatment</li></ul>	<ul style="list-style-type: none"><li>• Additional harms from screening with CT colonography arise from colonoscopy to follow up abnormal CT colonography results</li><li>• Requires bowel preparation</li><li>• Does not require anesthesia or sedation or transportation to and from the screening examination</li></ul>

# SCENARIO: Screening for Colon Cancer

Radiation Dose?

4-12 mSv

# SCENARIO: Screening for Colon Cancer



# SCENARIO: Stroke Alert

What is the most appropriate first imaging test?



# SCENARIO: Stroke Alert

What is the most appropriate first imaging test?

CT head without contrast

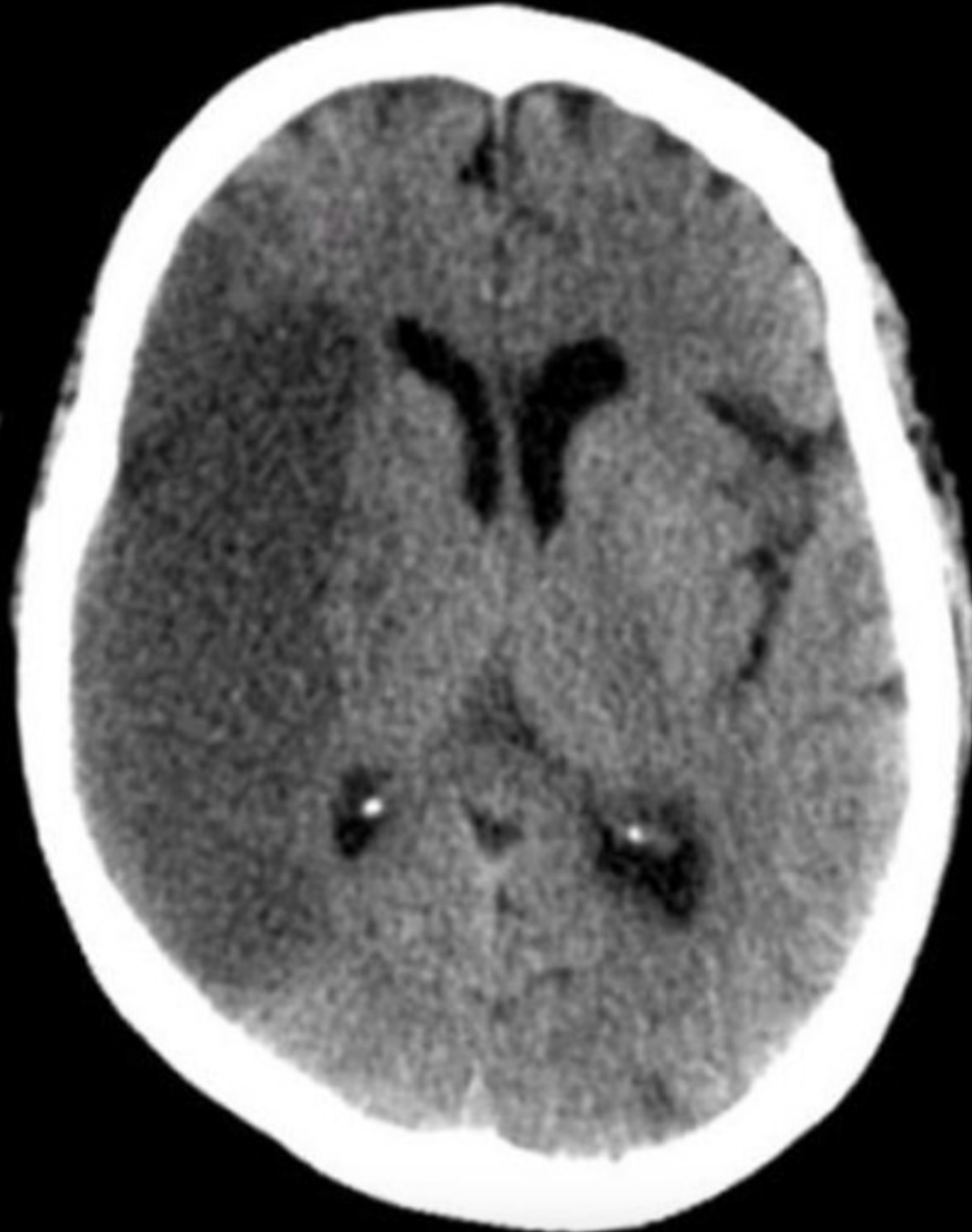
# SCENARIO: Stroke Alert

What is the main question the non-contrast CT head answers in acute stroke?

# SCENARIO: Stroke Alert

What is the main question the non-contrast CT head answers in acute stroke?

Hemorrhagic stroke or  
ischemic stroke





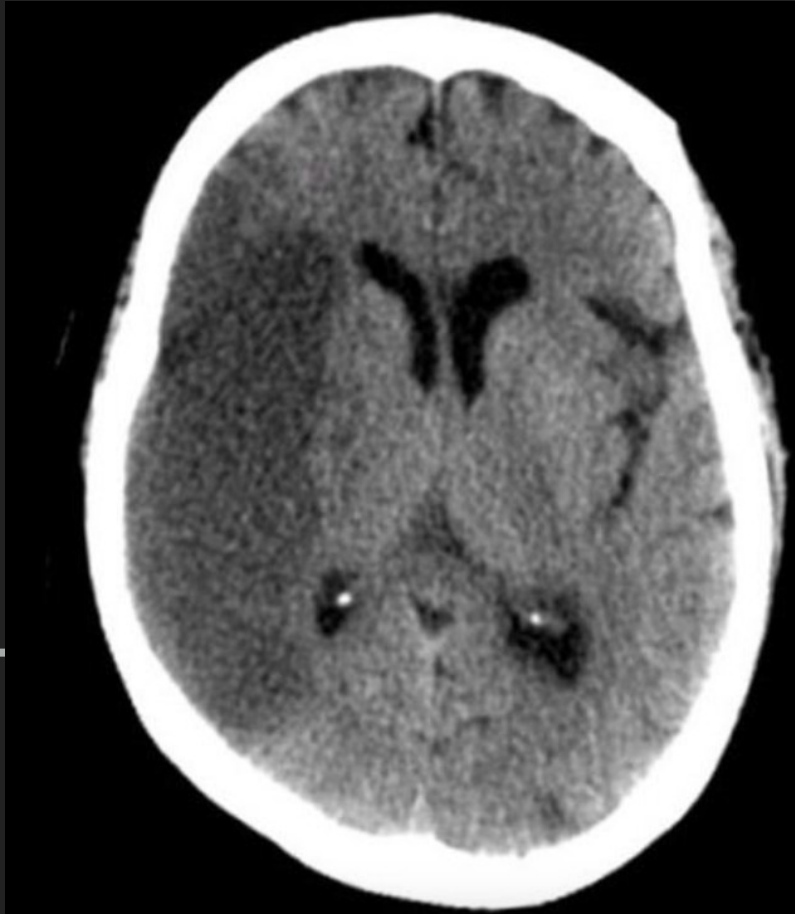


**Finding:**

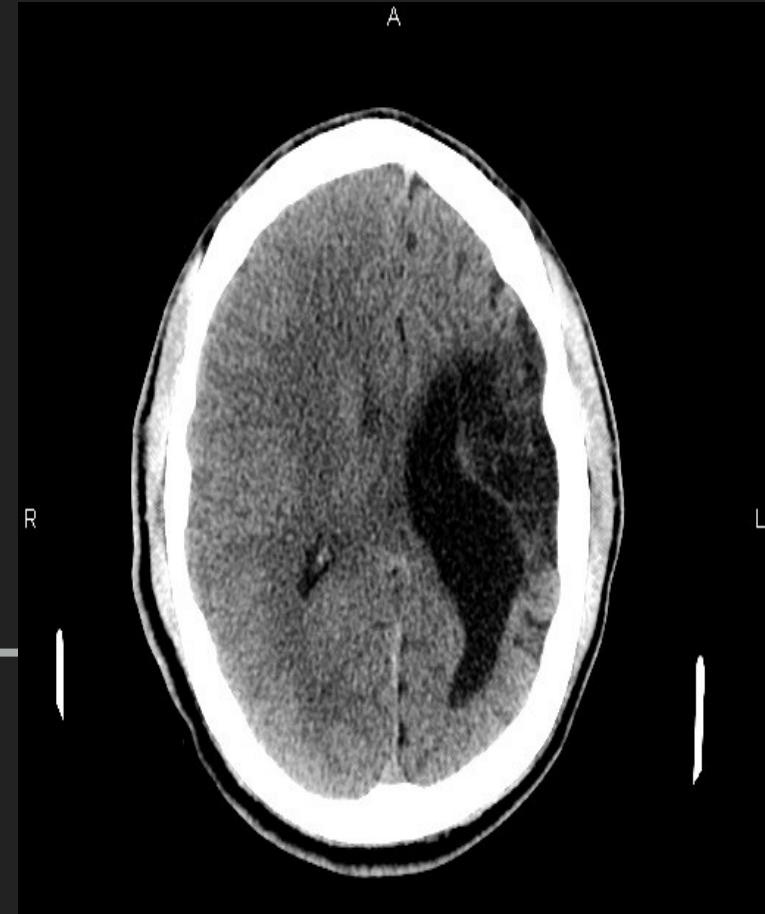
Edema in the frontal and parietal lobes, insula and basal ganglia

**Diagnosis:**

Acute right MCA territory infarct



Acute stroke  
Edema  
Positive mass effect



Old stroke or hemorrhage  
Encephalomalacia  
Negative mass effect

38



W 91 : L 41

A



R

L

38



W 91 : L 41

Subdural hematoma  
Crescentic

A



R

L

Epidural hematoma  
Lenticular / biconvex





# Subacute Subdural Hematomas



Acute Hyperdense

Chronic Hypodense

SCENARIO: Stroke Alert  
After hemorrhagic stroke is ruled out, what CT test can determine if an ischemic stroke is amenable to endovascular intervention?

SCENARIO: Stroke Alert  
After hemorrhagic stroke is ruled out, what CT test can determine if an ischemic stroke is amenable to endovascular intervention?

CT angiogram and CT perfusion



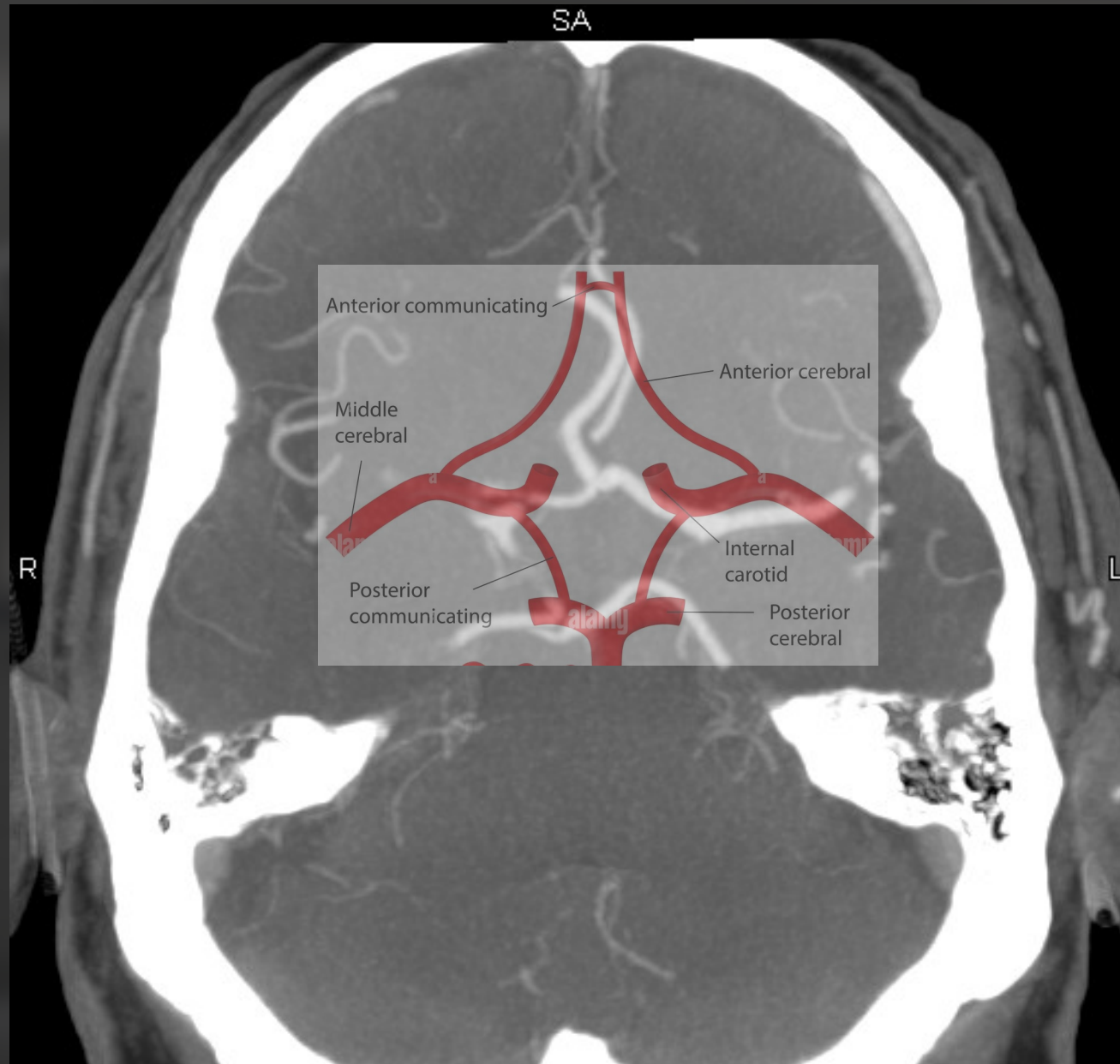
CT

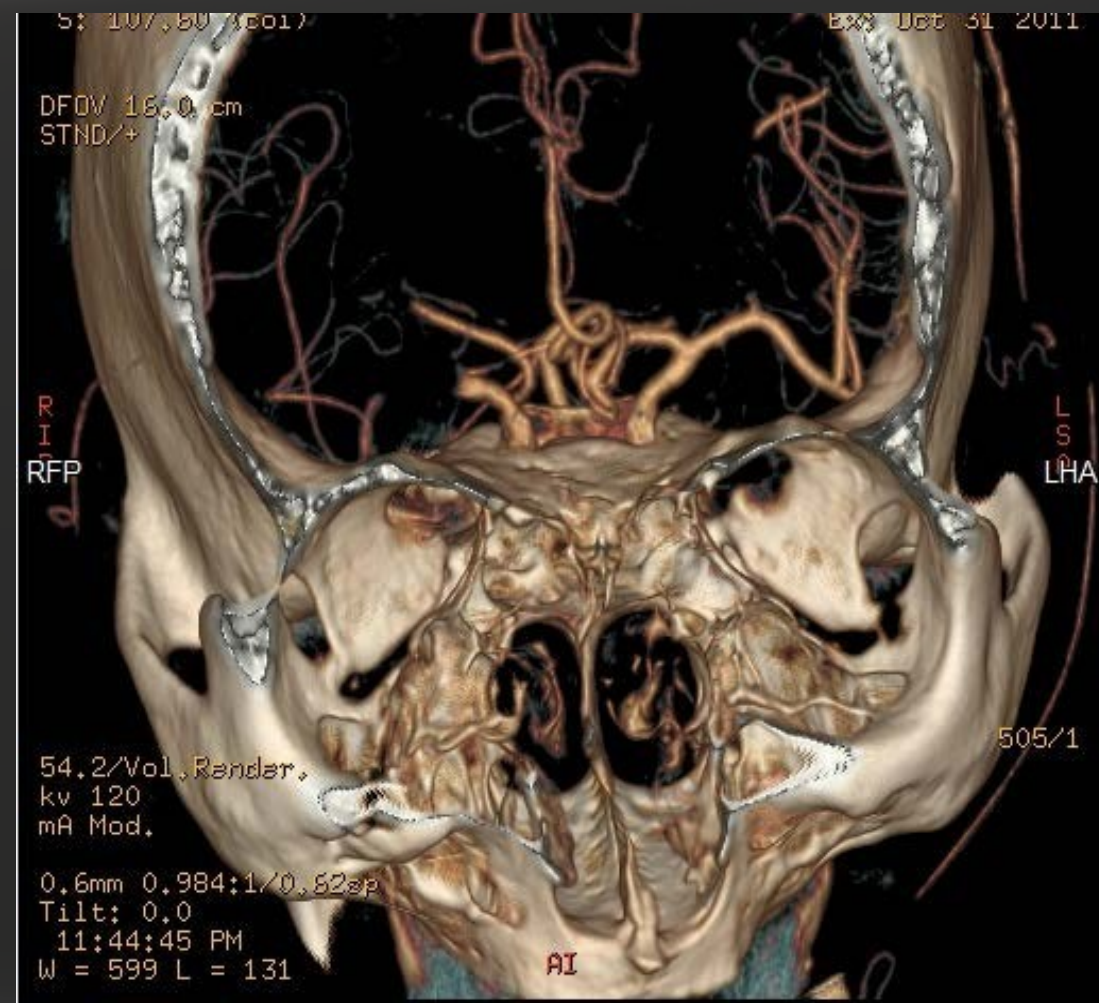
A: Is there  
a large  
vessel  
occlusion?



# CT

Is there  
a large  
vessel  
occlusion?



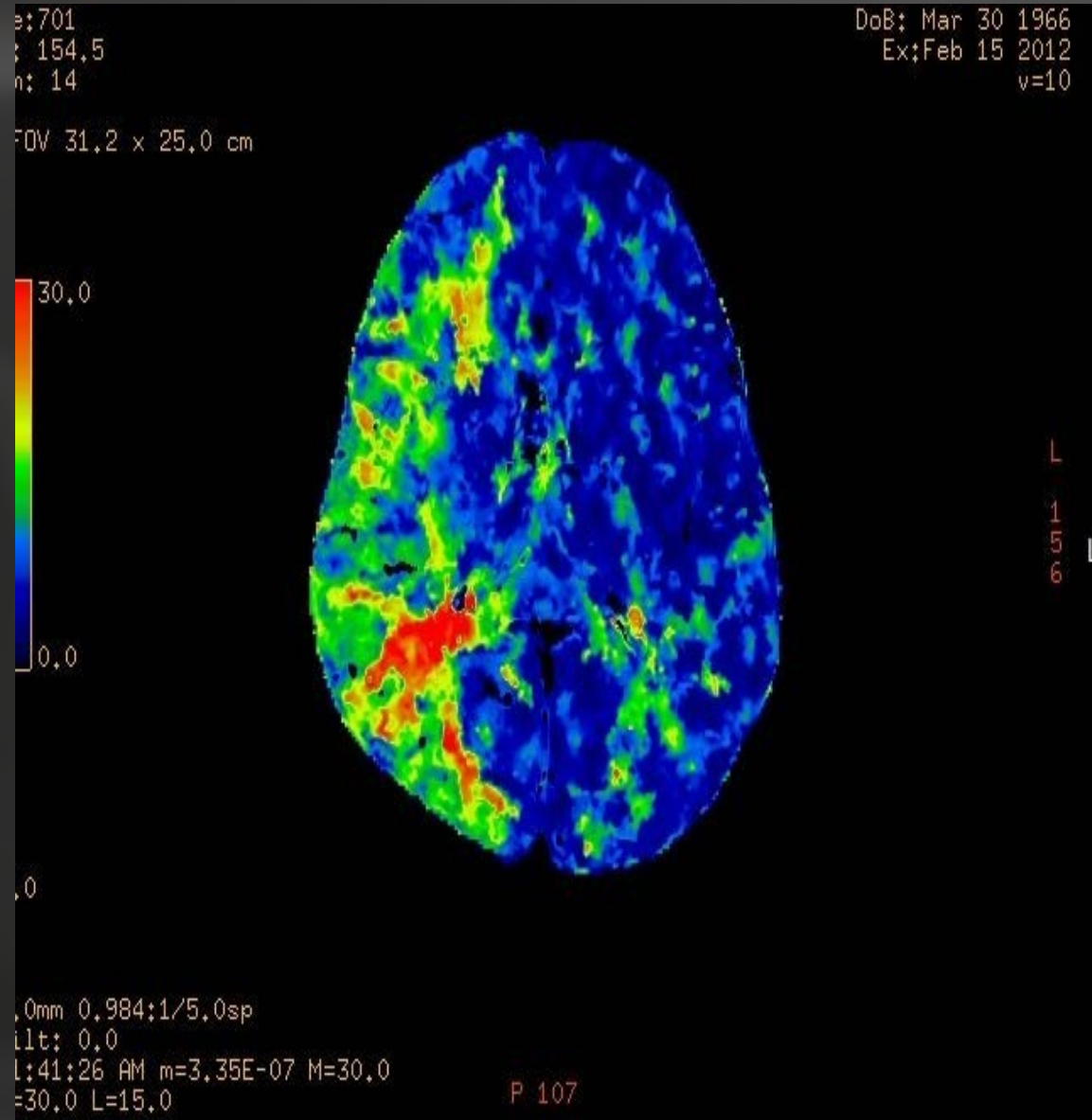




# CT

## Perfusion: Is there salvageable brain?

This scan maps the  
completed core  
infarct and the  
salvageable  
ischemic penumbra





# SCENARIO: Acute nonlocalized abdominal pain



SCENARIO: Acute nonlocalized  
abdominal pain

Which initial imaging test is  
usually appropriate?

- a) Abdominal radiograph
- b) CT abdomen/pelvis with IV contrast
- c) CT abdomen/pelvis without IV contrast
- d) US abdomen

# SCENARIO: Acute nonlocalized abdominal pain

Which initial imaging test is usually appropriate?

a) Abdominal radiograph

b) CT abdomen/pelvis with IV contrast

c) CT abdomen/pelvis without IV contrast

d) US abdomen

## American College of Radiology ACR Appropriateness Criteria® Acute Nonlocalized Abdominal Pain

### Variant 1:

Acute nonlocalized abdominal pain and fever. No recent surgery. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
CT abdomen and pelvis with IV contrast	Usually Appropriate	⦿⦿⦿⦿
MRI abdomen and pelvis without and with IV contrast	May Be Appropriate	○
US abdomen	May Be Appropriate	○
CT abdomen and pelvis without IV contrast	May Be Appropriate	⦿⦿⦿⦿
MRI abdomen and pelvis without IV contrast	May Be Appropriate	○
CT abdomen and pelvis without and with IV contrast	May Be Appropriate	⦿⦿⦿⦿⦿
Radiography abdomen	May Be Appropriate	⦿⦿
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⦿⦿⦿⦿⦿
WBC scan abdomen and pelvis	Usually Not Appropriate	⦿⦿⦿⦿⦿
Nuclear medicine scan gallbladder	Usually Not Appropriate	⦿⦿
Fluoroscopy contrast enema	Usually Not Appropriate	⦿⦿⦿⦿
Fluoroscopy upper GI series with small bowel follow-through	Usually Not Appropriate	⦿⦿⦿⦿

# SCENARIO: Acute nonlocalized abdominal pain

The range of pathology that can produce abdominal pain is broad and necessitates an imaging approach that can identify pathology in many different organ systems. Common pathologies include pneumonia, hepatobiliary disease, complicated pancreatic processes, nephrolithiasis, gastrointestinal (GI) perforation or inflammation, bowel obstruction or infarction, abscesses anywhere in the abdomen, and tumor—among numerous other causes. Of all patients who present to the emergency department (ED) with abdominal pain, about one-third never have a diagnosis established, one-third have appendicitis, and one-third have some other documented pathology. In the “other” category, the most common causes of abdominal pain include: acute cholecystitis, small-bowel obstruction (SBO), pancreatitis, renal colic, perforated peptic ulcer, cancer, and diverticulitis [1]. Imaging plays



# SCENARIO: Acute nonlocalized abdominal pain

CT abdomen/pelvis

Preferred when there is a broad differential and need for fast diagnosis

Abdominal radiograph

Limited sensitivity for abscess, appendicitis, diverticulitis, colitis, enteritis.

Only moderate sensitivity (49%) for bowel obstruction

US Abdomen

Similar sensitivity as CT for acute cholecystitis, but lower than CT for other causes of acute abdominal pain

# SCENARIO: Acute nonlocalized abdominal pain

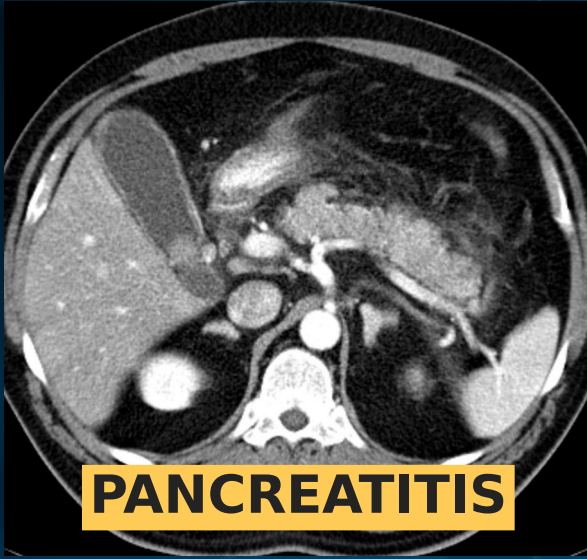


# SCENARIO: Acute nonlocalized abdominal pain

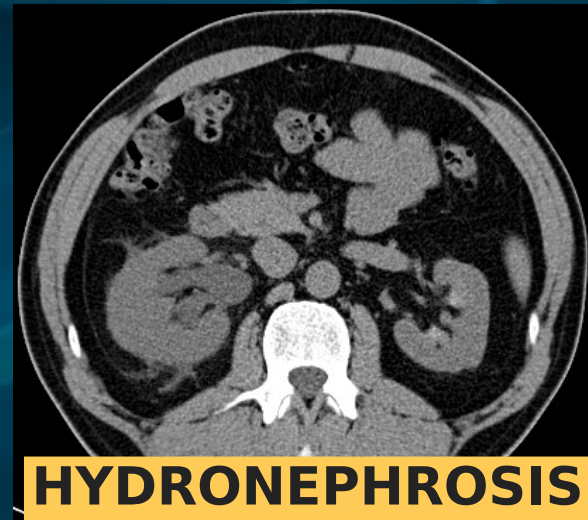


Pyelonephritis

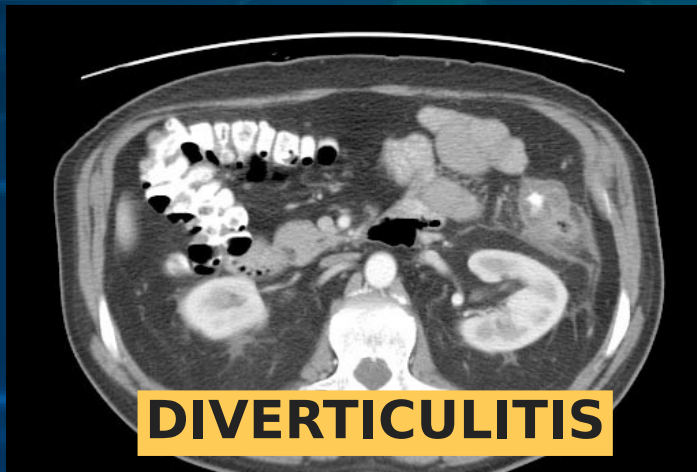
# SCENARIO: Acute nonfocalized abdominal pain



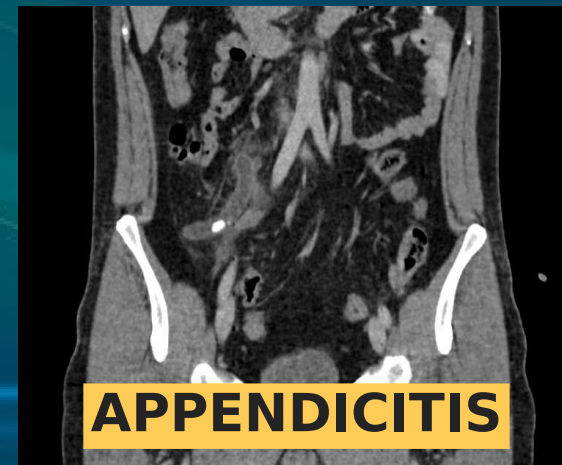
**PANCREATITIS**



**HYDRONEPHROSIS**



**DIVERTICULITIS**



**APPENDICITIS**

SCENARIO: Chest pain with high pre-test probability of PE

Appropriate test?



# SCENARIO: Chest pain with high pre-test probability of PE

## Appropriate test?

Scenario	Scenario ID	Procedure	Adult RRL	Peds RRL	Appropriateness Category
Pulmonary embolism suspected, high pretest probability, initial imaging	3195265	● CTA pulmonary arteries with IV contrast	1-10 mSv ☢☢☢		Usually appropriate
		● V/Q scan lung	1-10 mSv ☢☢☢		Usually appropriate

SCENARIO: Chest pain with  
intermediate pre-test probability of  
PE, positive D-dimer

Appropriate test?

# SCENARIO: Chest pain with intermediate pre-test probability of PE, positive D-dimer

## Appropriate test?

Scenario	Scenario ID	Procedure	Adult RRL	Peds RRL	Appropriateness Category
Pulmonary embolism suspected, intermediate pretest probability, positive D-dimer, initial imaging	3195263	● CTA pulmonary arteries with IV contrast	1-10 mSv ☢☢☢		Usually appropriate
		● V/Q scan lung	1-10 mSv ☢☢☢		Usually appropriate

SCENARIO: Chest pain with  
intermediate pre-test probability of  
PE, negative D-dimer

Approp  
riate  
test?

# SCENARIO: Chest pain with intermediate pre-test probability of PE, negative D-dimer

Appropriate test?

Scenario	Scenario ID	Procedure	Adult RRL	Peds RRL	Appropriateness Category
Pulmonary embolism suspected, intermediate pretest probability, negative D-dimer, initial imaging	3195260	● US duplex Doppler lower extremity	0 mSv ○	0 mSv [ped] ○	Usually not appropriate
		● US echocardiography transesophageal	0 mSv ○	0 mSv [ped] ○	Usually not appropriate
		● US echocardiography transthoracic resting	0 mSv ○	0 mSv [ped] ○	Usually not appropriate
		● Arteriography pulmonary with right heart catheterization	10-30 mSv ⊗⊗⊗⊗		Usually not appropriate
		● MRA pulmonary arteries without and with IV contrast	0 mSv ○	0 mSv [ped] ○	Usually not appropriate
		● MRA pulmonary arteries without IV contrast	0 mSv ○	0 mSv [ped] ○	Usually not appropriate
		● CT chest with IV contrast	1-10 mSv ⊗⊗⊗	3-10 mSv [ped] ⊗⊗⊗⊗	Usually not appropriate
		● CT chest without and with IV contrast	1-10 mSv ⊗⊗⊗	3-10 mSv [ped] ⊗⊗⊗⊗	Usually not appropriate



# SCENARIO: Possible Acute Coronary Syndrome

## Appropriate test?

**American College of Radiology  
ACR Appropriateness Criteria®  
Chest Pain-Possible Acute Coronary Syndrome**

**Variant 1:**

**Chest pain, low to intermediate probability for acute coronary syndrome. Initial imaging.**

# SCENARIO: Possible Acute Coronary Syndrome

## Appropriate test?

**American College of Radiology  
ACR Appropriateness Criteria®  
Chest Pain-Possible Acute Coronary Syndrome**

**Variant 1:**                      **Chest pain, low to intermediate probability for acute coronary syndrome. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
CTA coronary arteries with IV contrast	Usually Appropriate	⚠⚠⚠
Radiography chest	Usually Appropriate	⚠
SPECT or SPECT/CT MPI rest and stress	Usually Appropriate	⚠⚠⚠⚠
US echocardiography transthoracic stress	Usually Appropriate	○

# SCENARIO: Possible Acute Coronary Syndrome

## Appropriate test?

**Variant 2:**

**Chest pain, high probability for acute coronary syndrome. Initial imaging.**

# SCENARIO: Possible Acute Coronary Syndrome

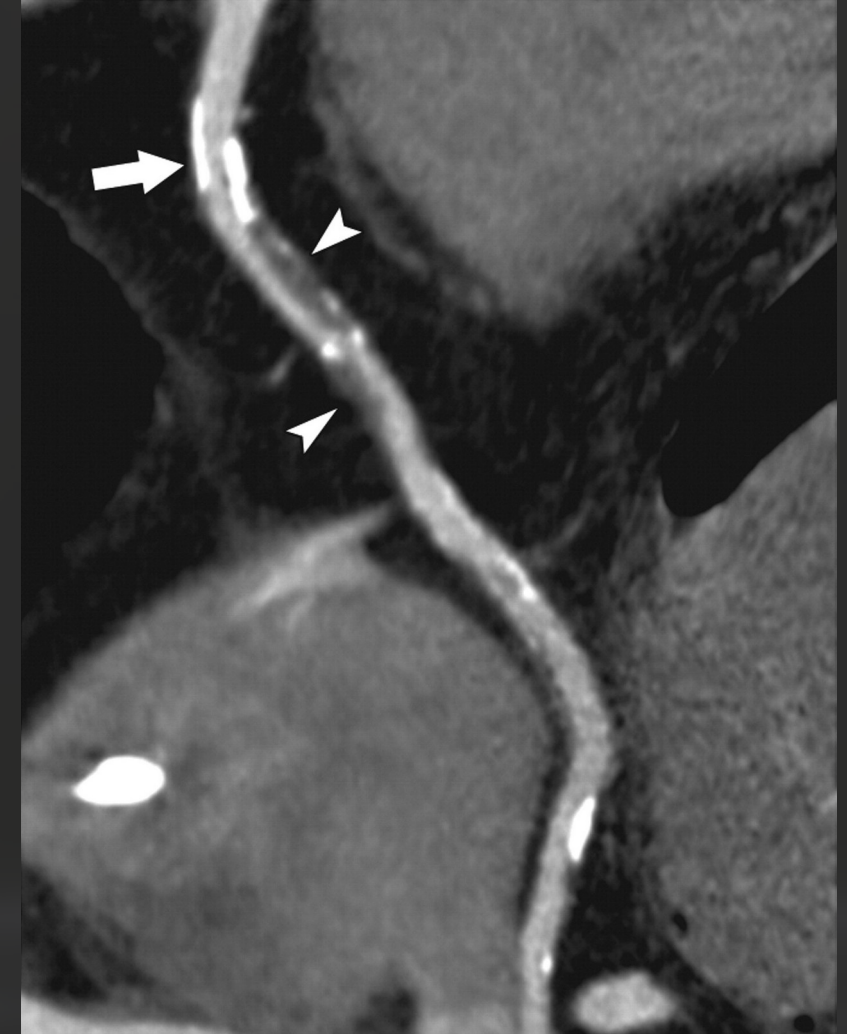
## Appropriate test?

### **Variant 2:**

**Chest pain, high probability for acute coronary syndrome. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
Arteriography coronary	Usually Appropriate	☢☢☢
Radiography chest	Usually Appropriate	☢

# SCENARIO: Possible Acute Coronary Syndrome





SCENARIO: Diffuse lung disease  
suspected  
Appropriate test?

# SCENARIO: Diffuse lung disease suspected

## Appropriate test?

Scenario	Scenario ID	Procedure	Adult RRL	Peds RRL	Appropriateness Category
Diffuse lung disease suspected, initial imaging	3194239	● Radiography chest	<0.1 mSv ☢	<0.03 mSv [ped] ☢	Usually appropriate
		● CT chest without IV contrast	1-10 mSv ☢☢☢	3-10 mSv [ped] ☢☢☢☢	Usually appropriate

# SCENARIO: Diffuse lung disease suspected

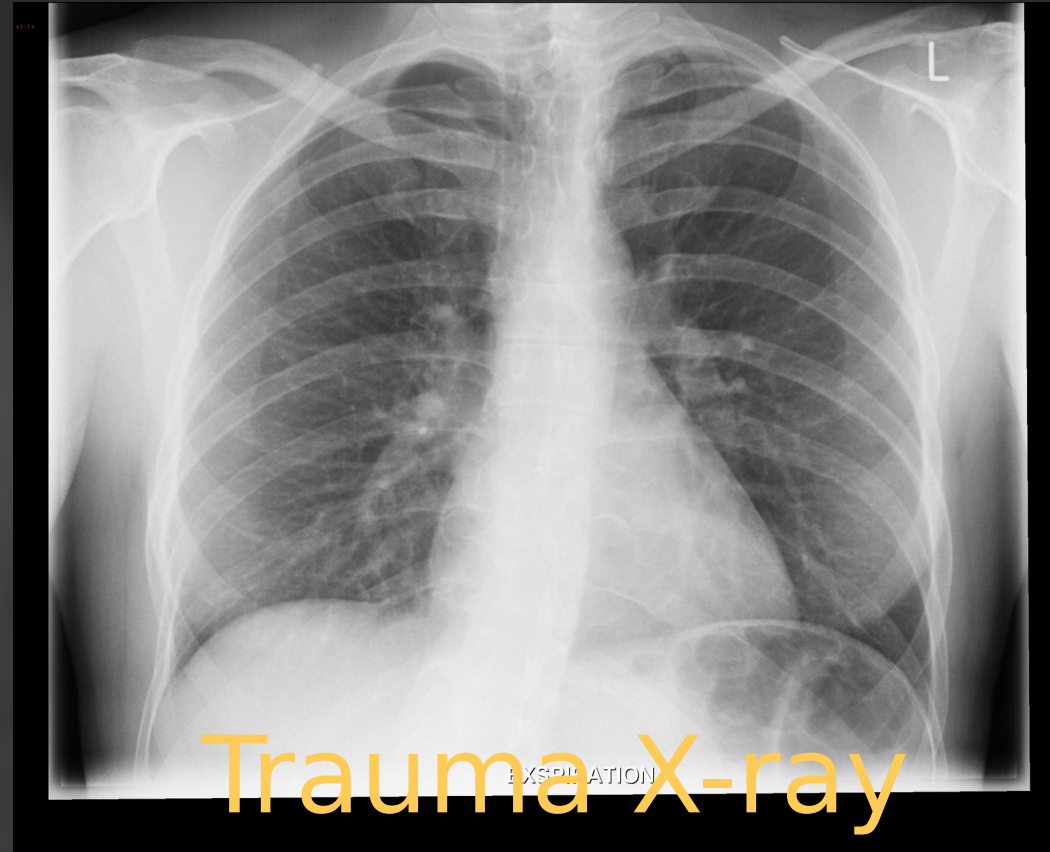


SCENARIO: Major Blunt Trauma,  
hemodynamically unstable  
Appropriate test?

# SCENARIO: Major Blunt Trauma, hemodynamically unstable Appropriate test?



US FAST Scan



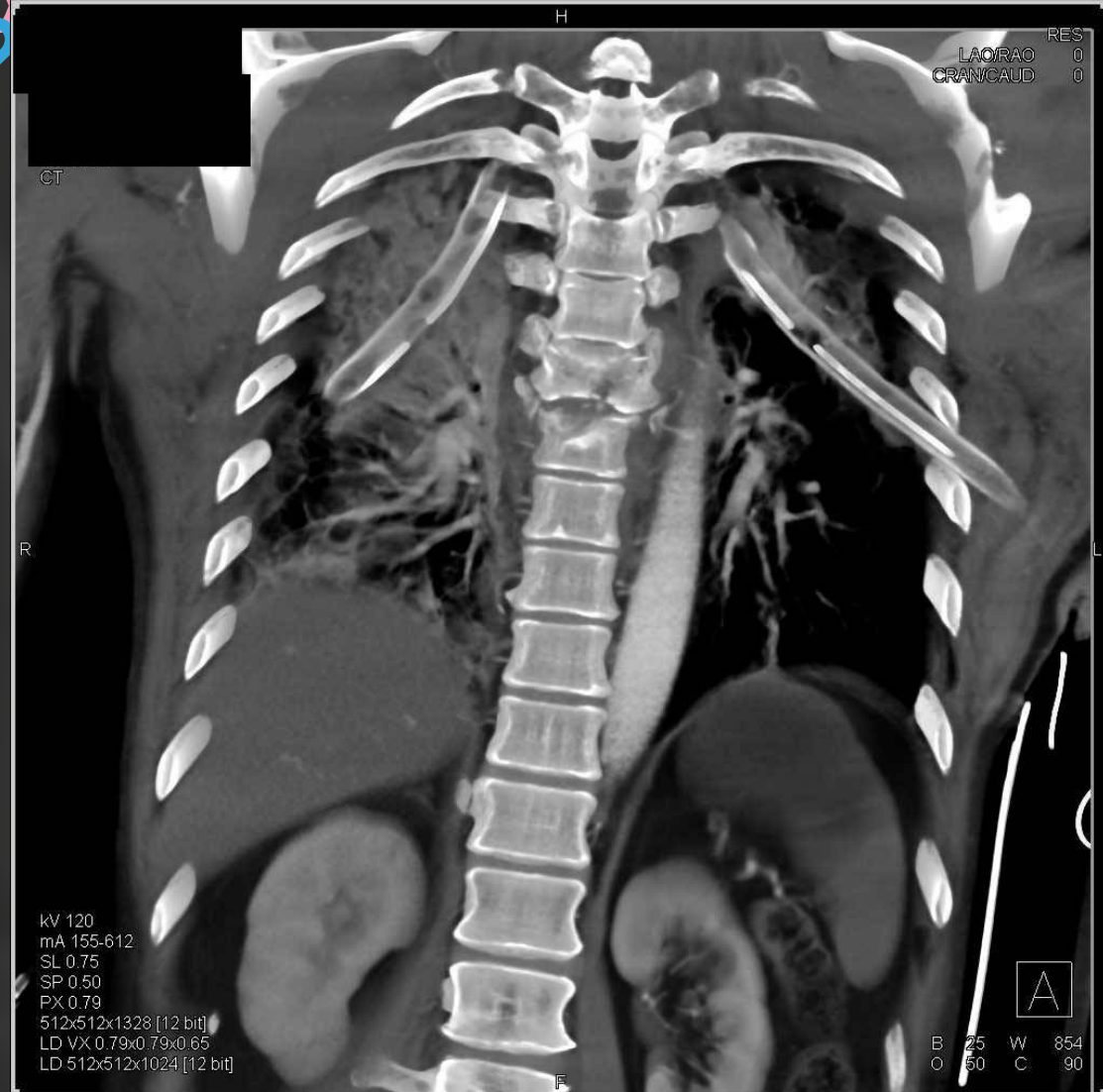
Trauma X-ray  
series



# SCENARIO: Major Blunt Trauma, hemodynamically stable Appropriate test?

## Trauma CT:

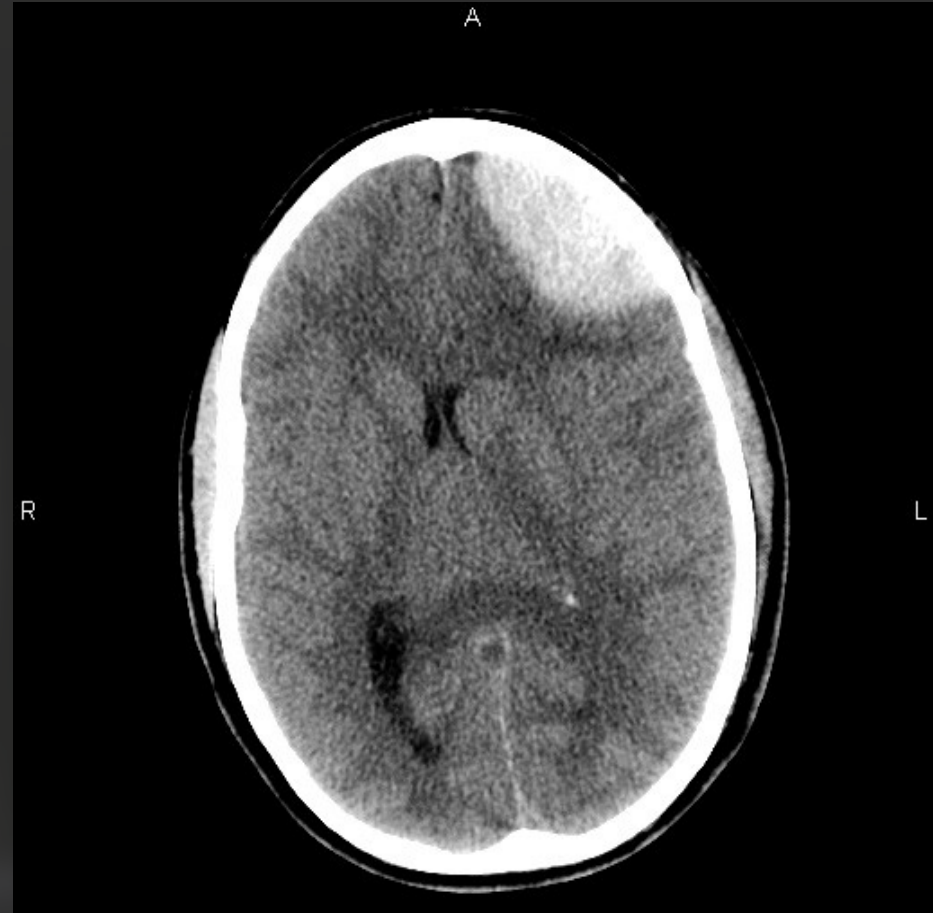
Head, C-spine,  
Chest,  
Abdomen,  
Pelvis



# Trauma



# Trauma



# Trauma





# Trauma

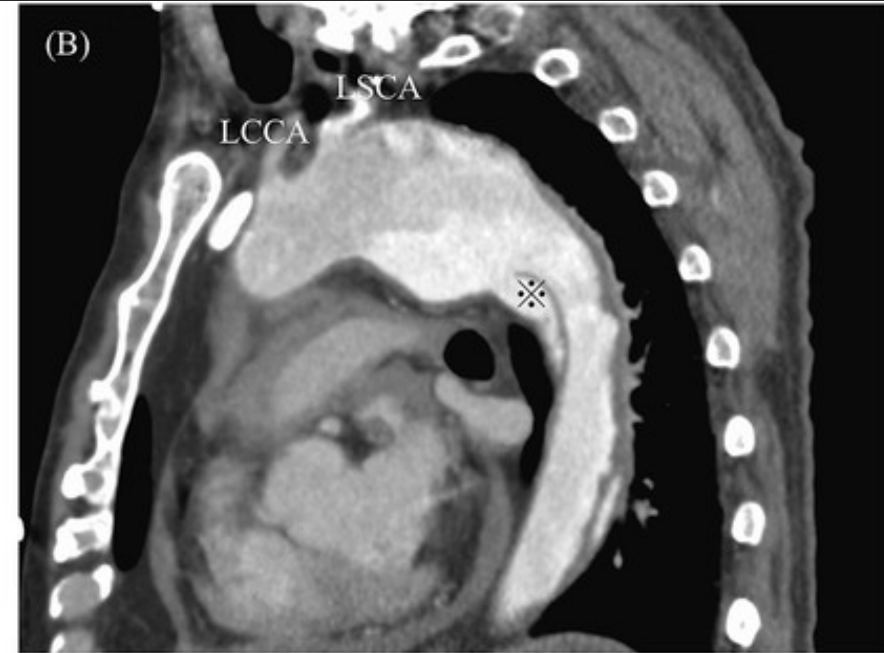
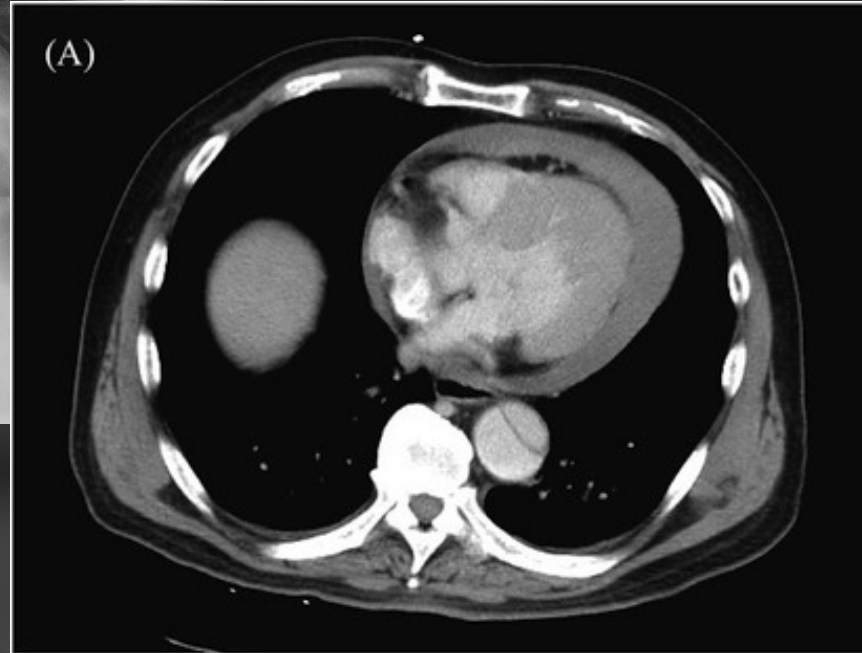
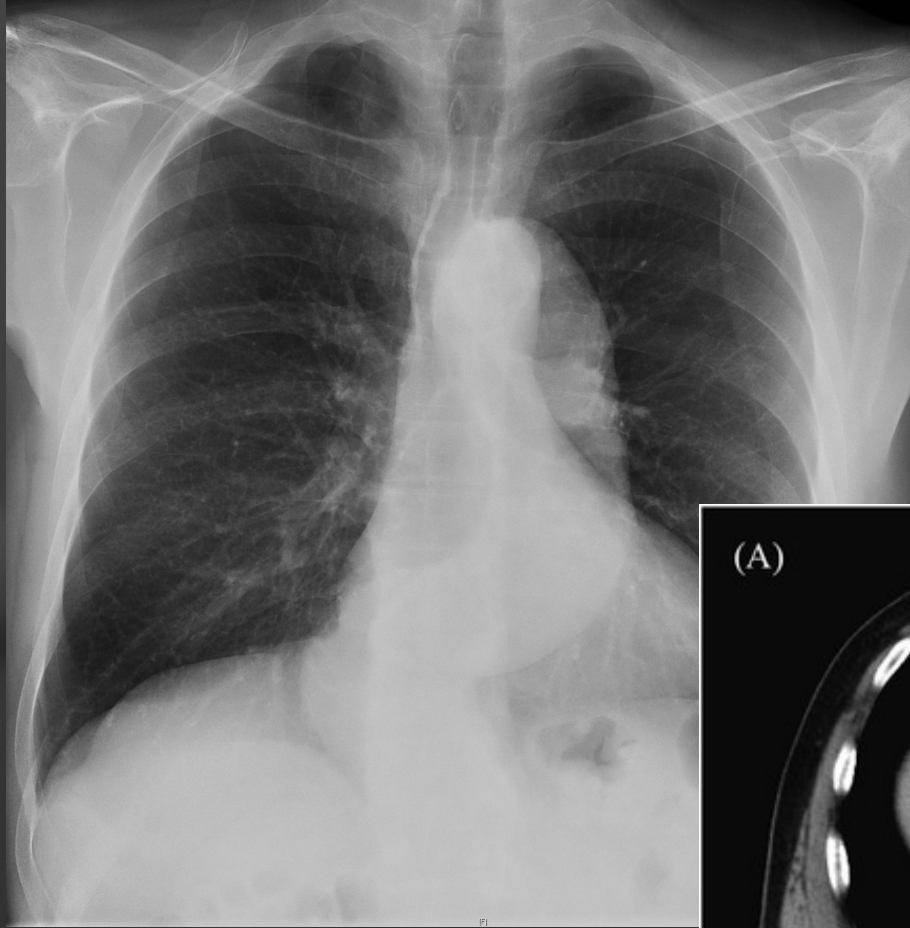




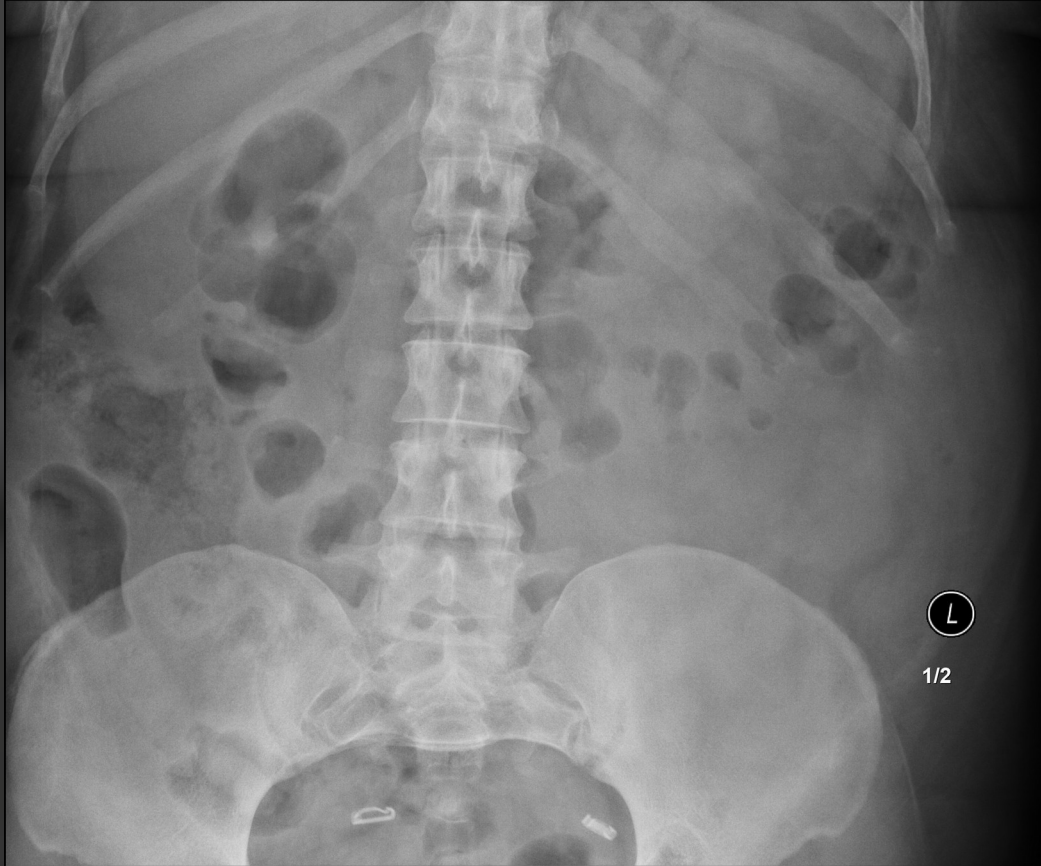
# Trauma



# Trauma

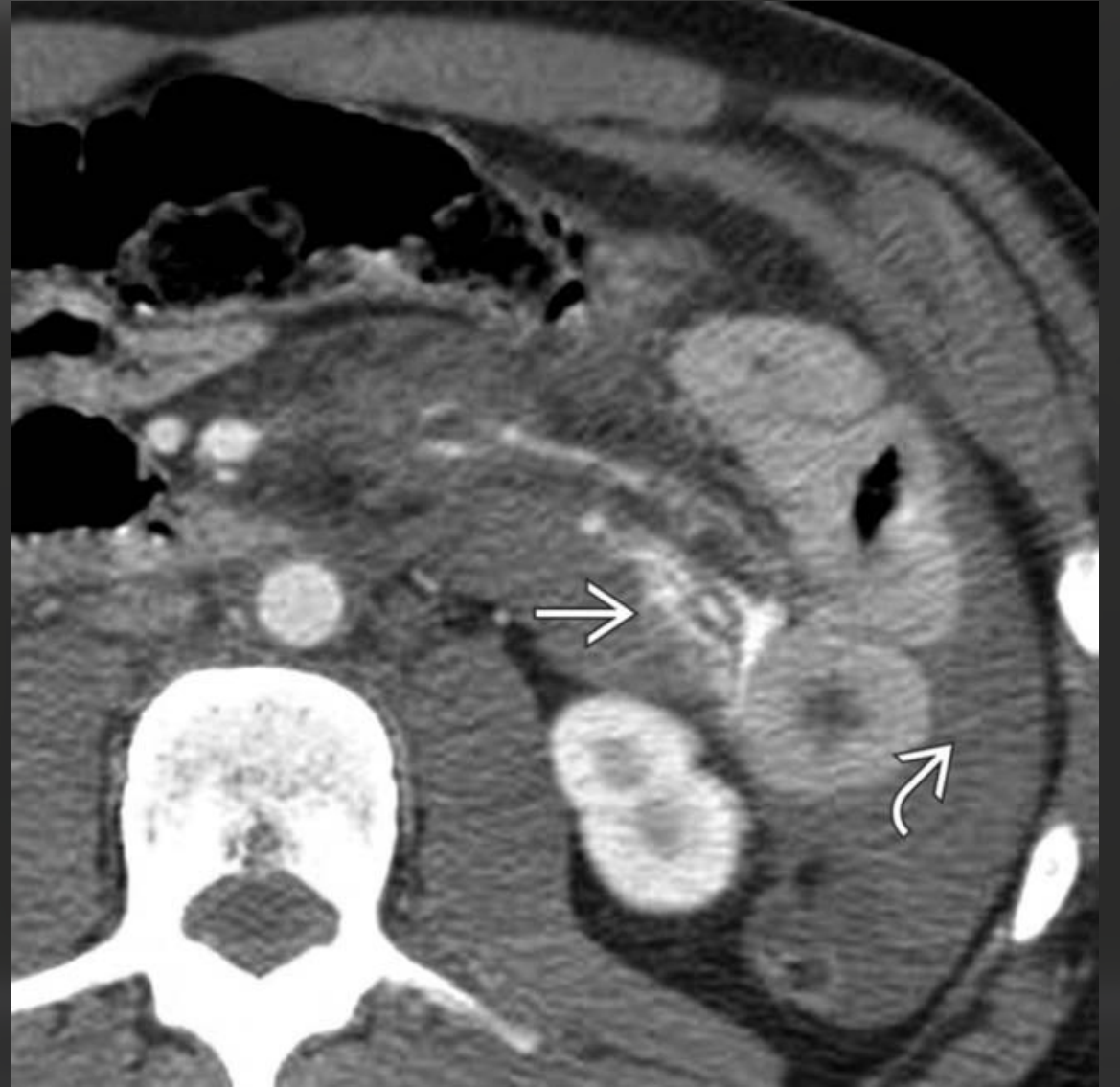
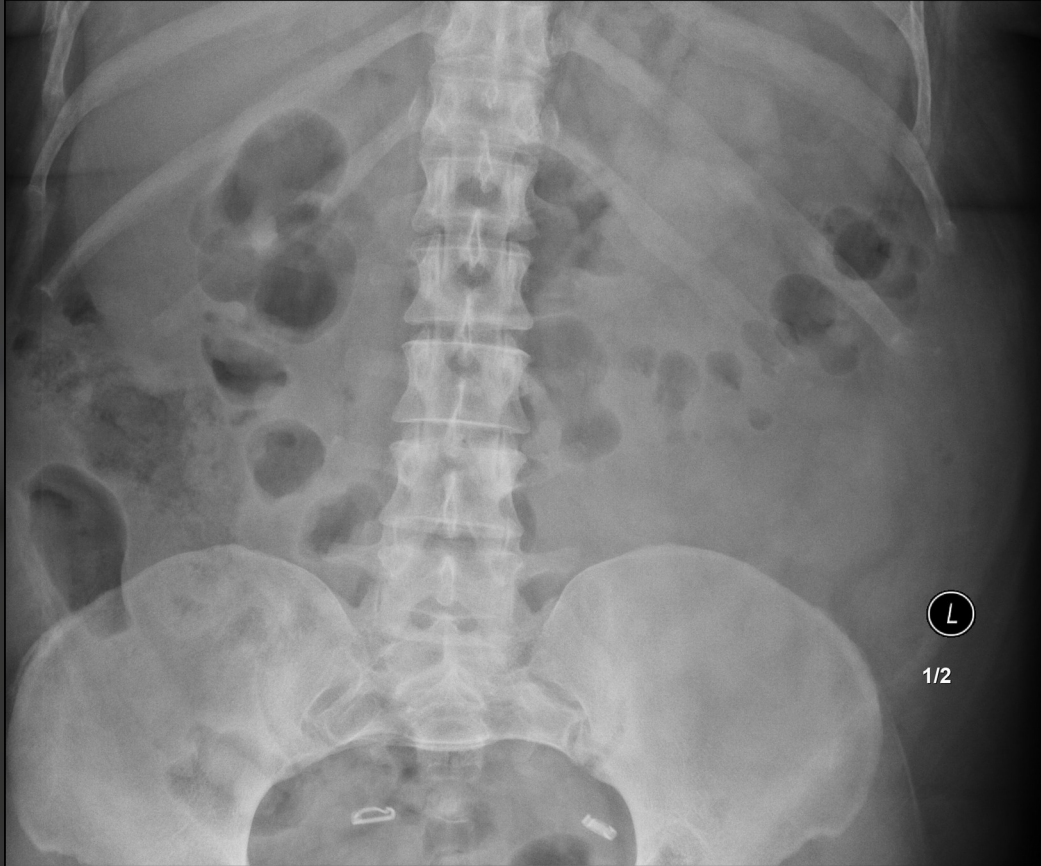


# Trauma

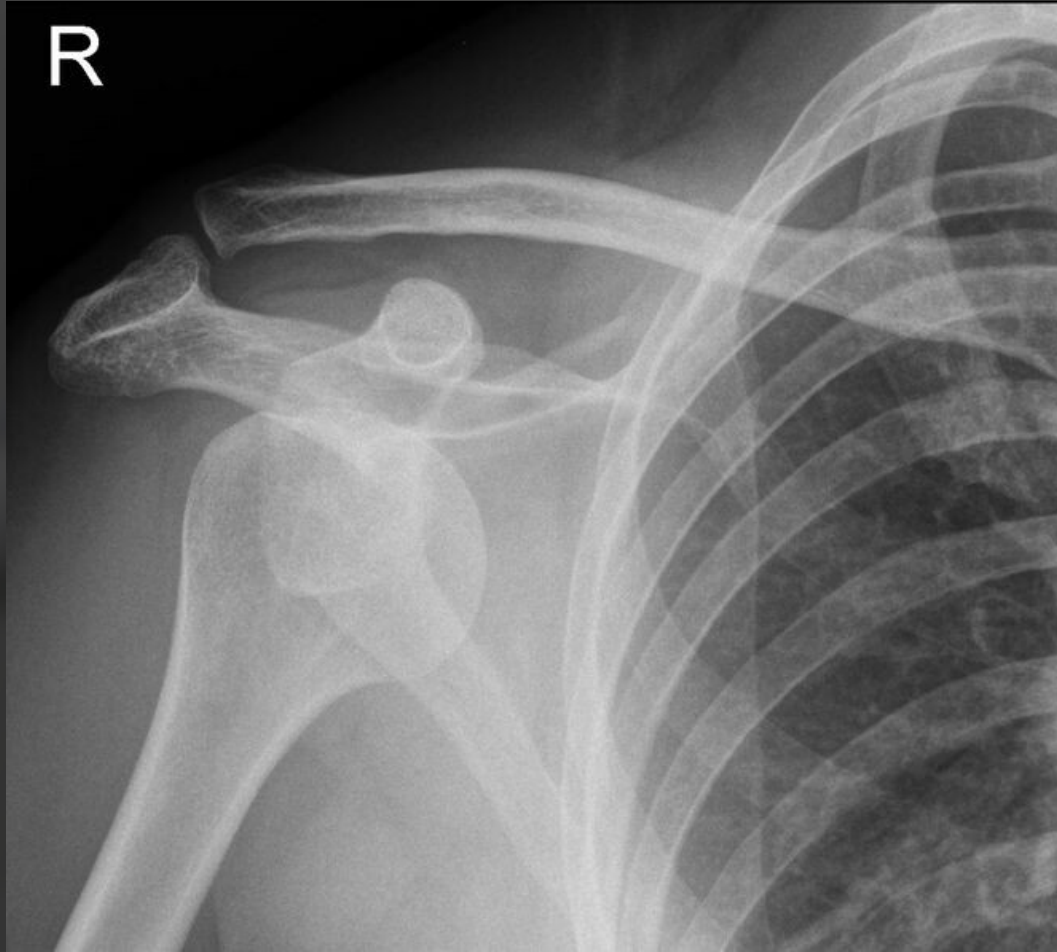




# Trauma

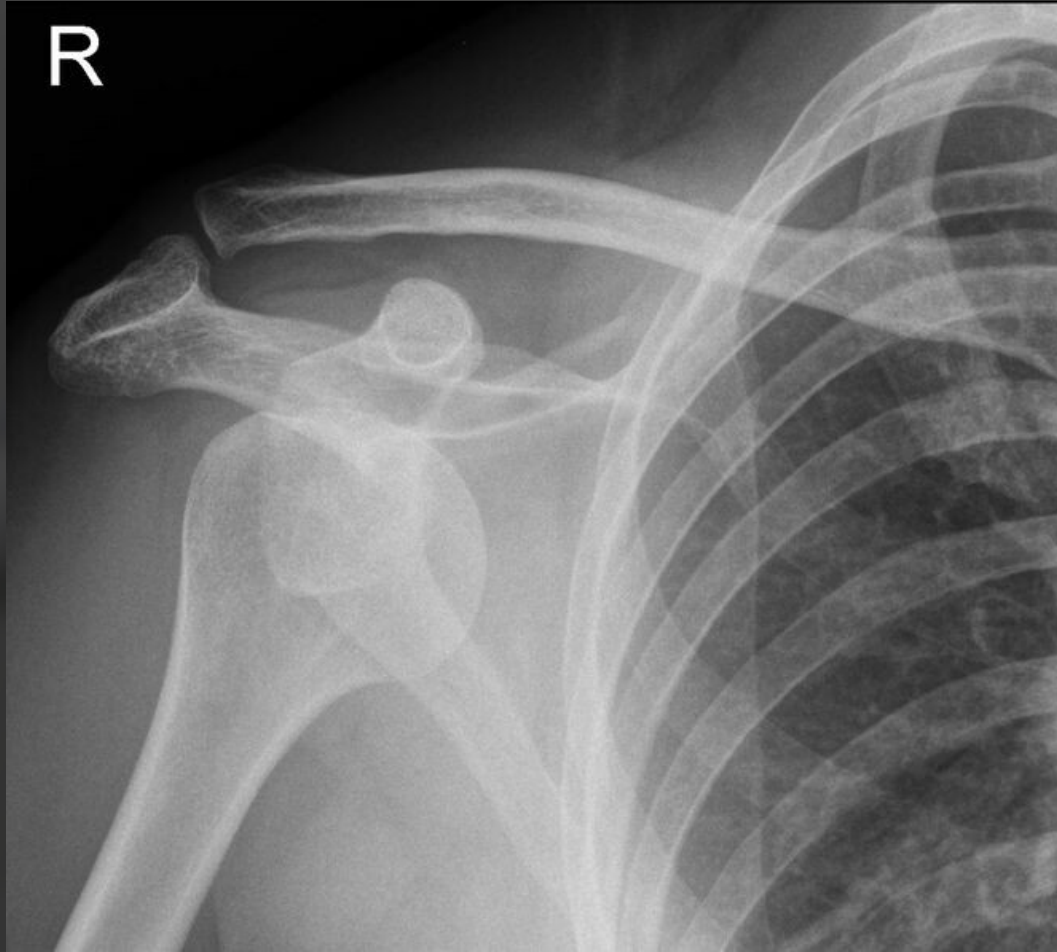


# Trauma





# Trauma



# Trauma



# Trauma



# SCENARIO: Acute Respiratory Illness

When is CT appropriate?

Clinical findings:

Positive physical  
examination

Abnormal vitals

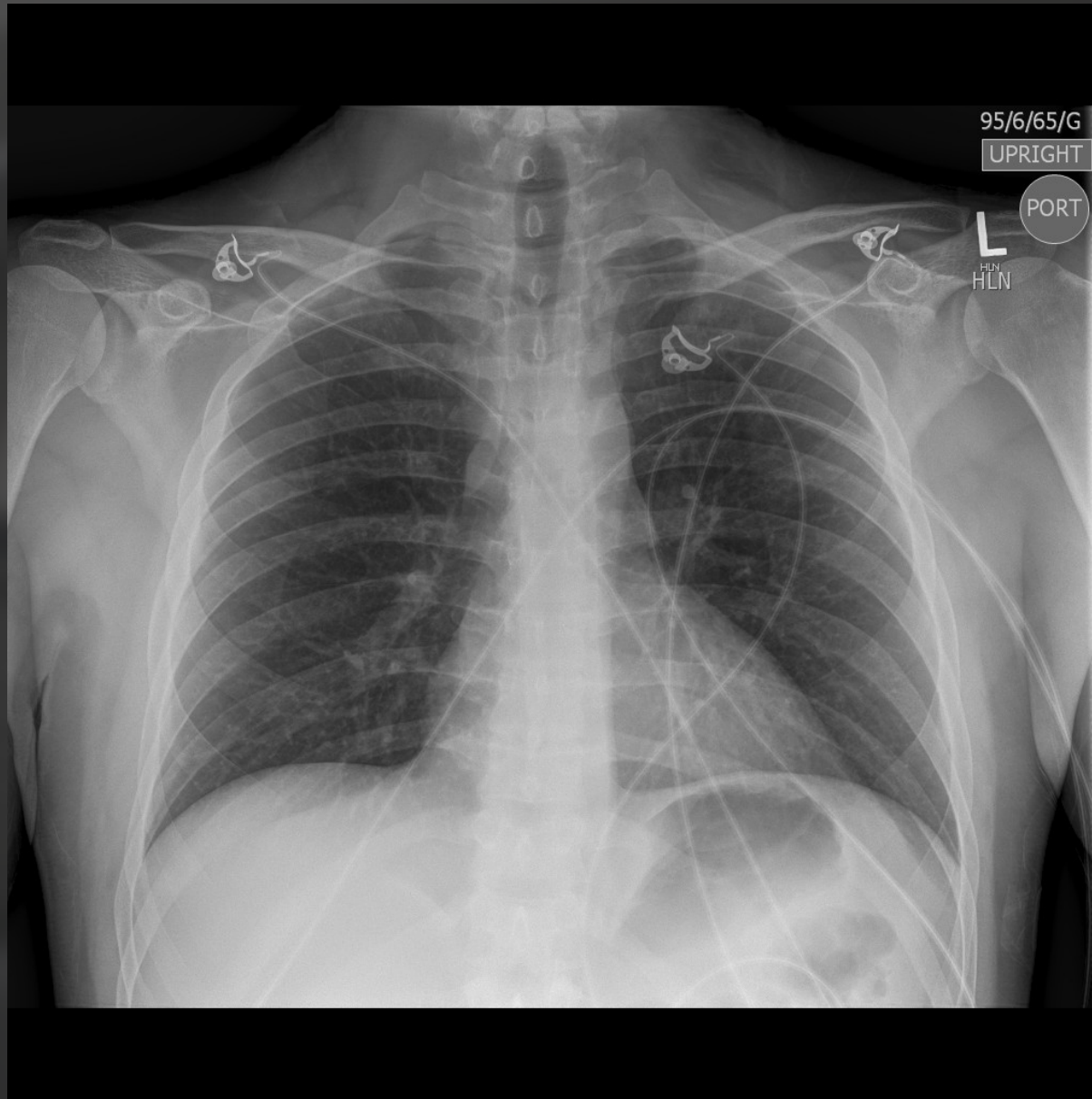
Organic brain  
disease

And:

Negative  
or  
equivocal  
CXR

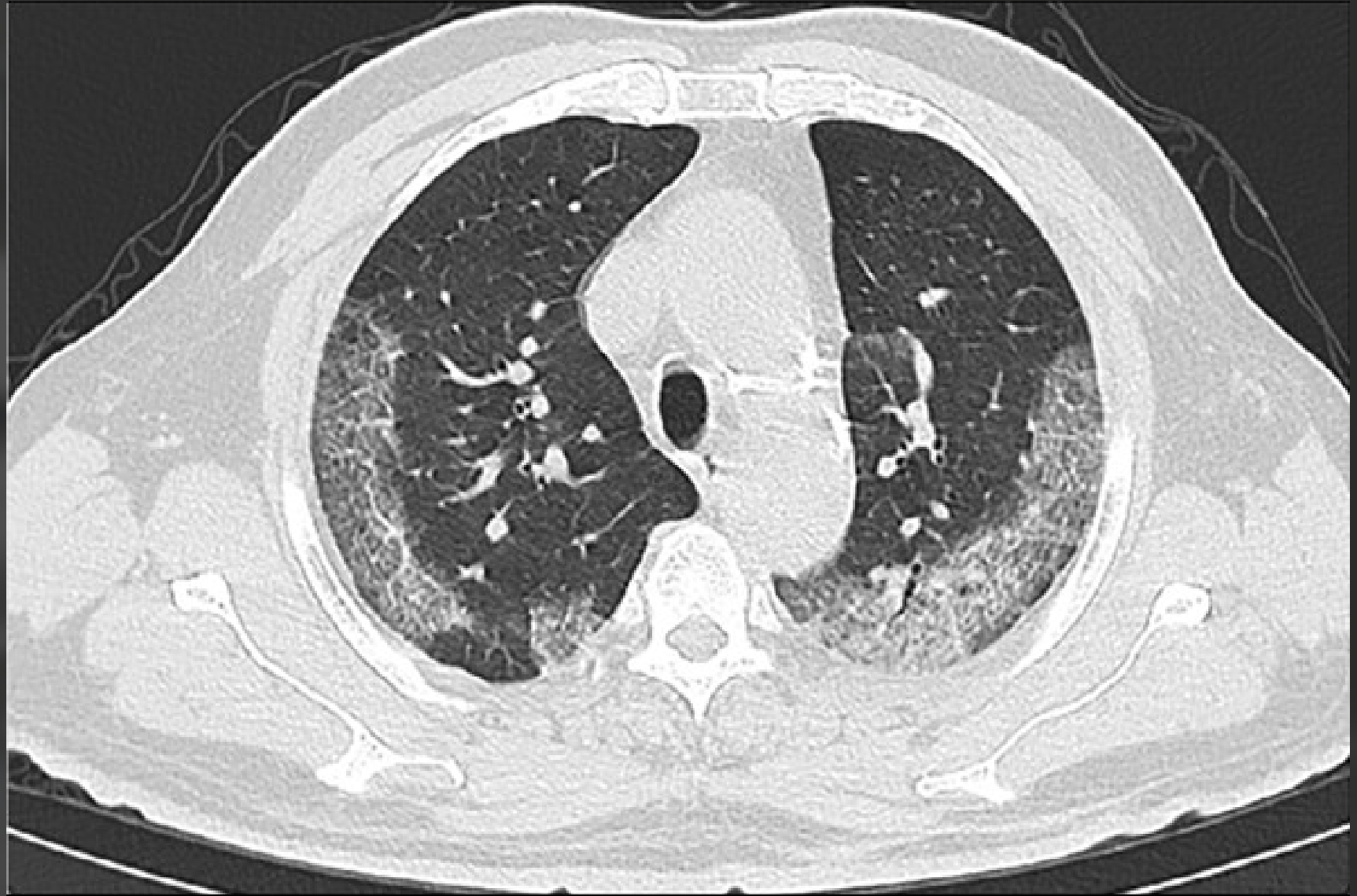
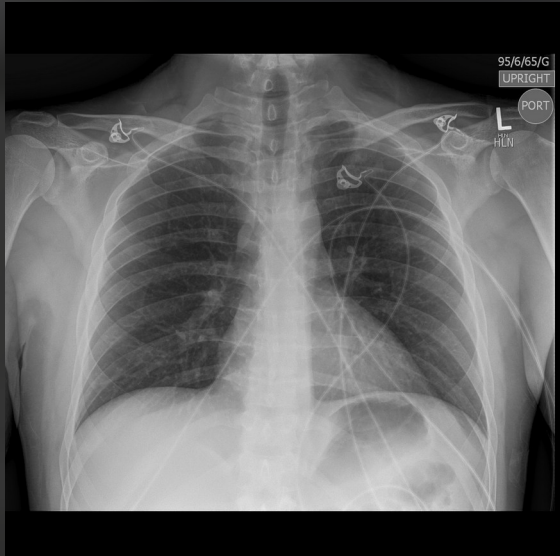


# SCENARIO: Acute Respiratory Illness

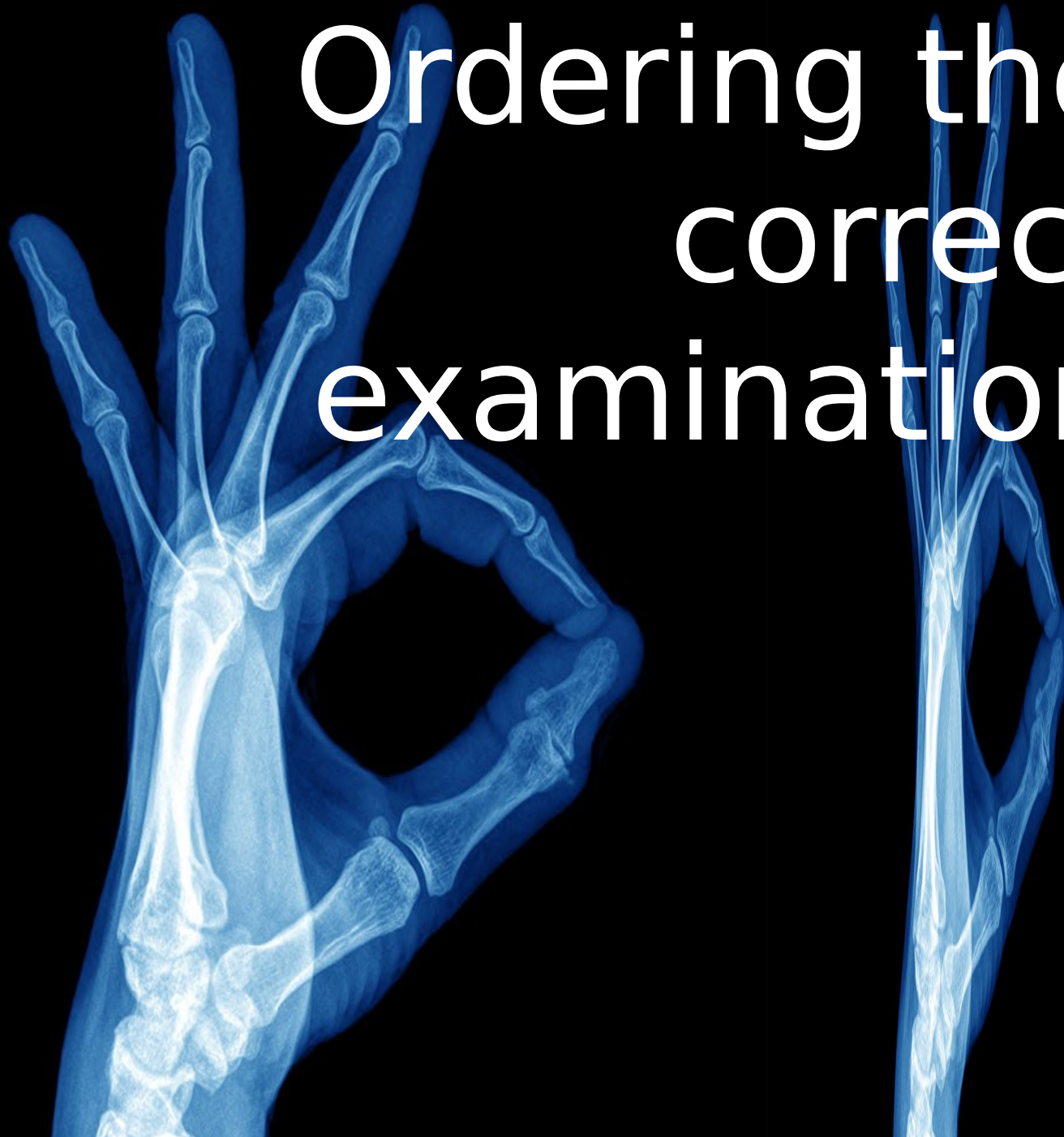




# SCENARIO: Acute Respiratory Illness



# Ordering the correct examination



Appropriate Use: ACR Appropriateness Criteria

Evidence based guidelines  
for selecting appropriate  
imaging tests

<https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria>

Enter your search

Clinical Quality  
Resources

Advocacy and  
Economics

Lifelong Learning and  
CME

Member  
Resources

Prac  
Qu

## Quality & Safety

### ACR Appropriateness Criteria® (AC) now includes



**233** diagnostic imaging and  
interventional radiology documents.

**1,100** clinical variants.

**3,000** clinical scenarios.

**130** AC patient-friendly summaries  
published in JACR®.

## AC Portal

An interactive way to access the AC topics, variants, clinical scenarios, and recommendations. Use keyword filters and search features to more easily find all content.

Explore the AC [↗](#)

# APPROPRIATE USE: ACR APPROPRIATENESS CRITERIA



## Priority Clinical Areas

A11

## Search

Total Records: 69

# Appropriate Use: ACR Appropriateness Criteria

## ACR Appropriateness Criteria®

<b><u>Clinical Condition:</u></b> Right Lower Quadrant Pain—Suspected Appendicitis			
<b><u>Variant 1:</u></b> Fever, leukocytosis, and classic clinical presentation for appendicitis in adults.			
Radiologic Procedure	Rating	Comments	<u>RRL*</u>
CT abdomen and pelvis with contrast	8	Oral or rectal contrast may not be needed depending on institutional preference.	⊕ ⊕ ⊕ ⊕
CT abdomen and pelvis without contrast	7	Use of oral or rectal contrast depends on institutional preference.	⊕ ⊕ ⊕ ⊕
US abdomen	6	Perform this procedure with graded compression.	O
US pelvis	5	This procedure is appropriate in women with pelvic pain.	O
MRI abdomen and pelvis without and with contrast	5	See statement regarding contrast in text under “Anticipated Exceptions.”	O
X-ray abdomen	4	This procedure may be useful when there is concern for perforation and free air.	⊕ ⊕
CT abdomen and pelvis without and with contrast	4	Oral or rectal contrast may not be needed in this procedure depending on institutional preference.	⊕ ⊕ ⊕ ⊕
MRI abdomen and pelvis without contrast	4		O
X-ray contrast enema	2		⊕ ⊕ ⊕
Tc-99m WBC scan abdomen and pelvis	2		⊕ ⊕ ⊕ ⊕
<b><u>Rating Scale:</u></b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>

# Appropriate Use: ACR Appropriateness Criteria

## ACR Appropriateness Criteria®

**Clinical Condition:** Right Lower Quadrant Pain—Suspected Appendicitis

**Variant 3:** Fever, leukocytosis, pregnant woman.

Radiologic Procedure	Rating	Comments	<u>RRL*</u>
US abdomen	8	Perform this procedure with graded compression. This procedure is better in the first and early second trimester.	O
MRI abdomen and pelvis without contrast	7	This procedure may be useful following negative or equivocal US.	O
US pelvis	6		O

**Variant 4:** Fever, leukocytosis, possible appendicitis, atypical presentation in children (younger than age 14).

Radiologic Procedure	Rating	Comments	<u>RRL*</u>
US abdomen	8	Perform this procedure with graded compression.	O
CT abdomen and pelvis with contrast	7	This procedure may be useful following negative or equivocal US. Oral or rectal contrast may not be needed depending on institutional preference.	⊕ ⊕ ⊕ ⊕
		This procedure may be useful in excluding	

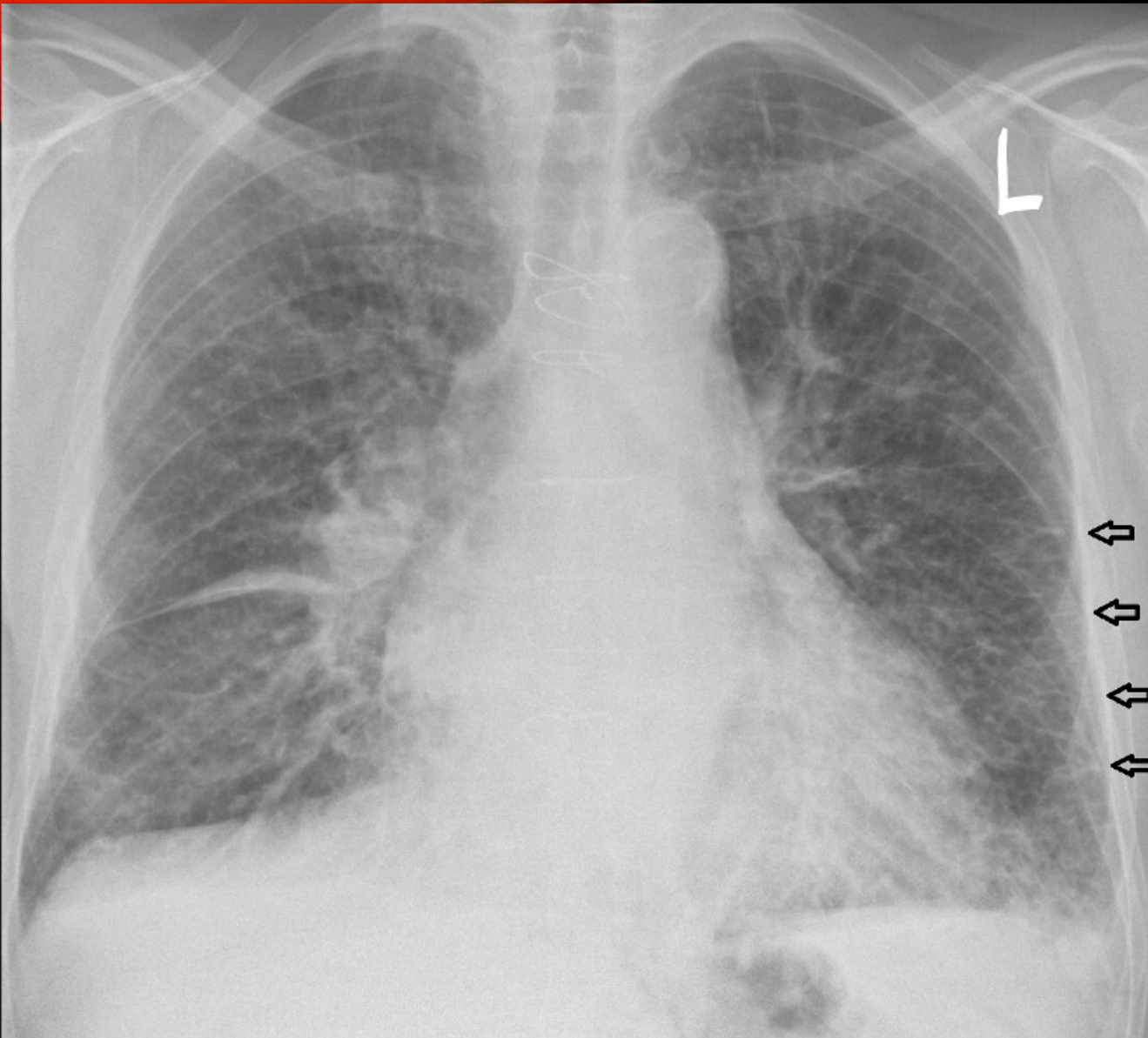






# Lightning Round





# MAGE QUESTION 1

Are these opacities an example of airspace disease or interstitial disease?

# IMAGE QUESTION 2

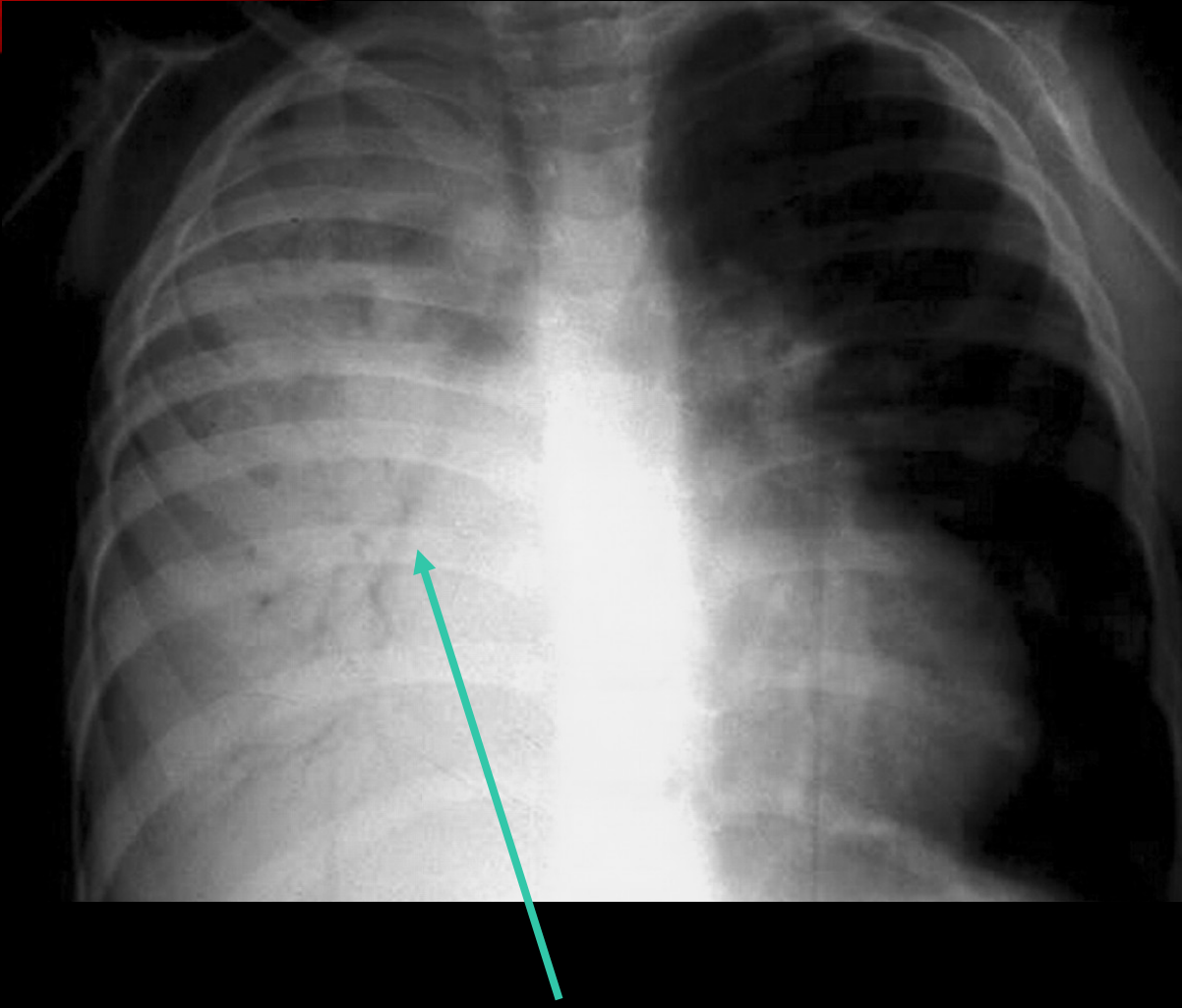
This is a technically inadequate chest radiograph. With regards to the exposure, is this image **overpenetrated** or **underpenetrated**?



## MAGE QUESTION 3

The (CHOOSE: air bronchogram / meniscus / silhouette) sign describes these lucent branching features on chest radiography, and is a sign that the surrounding opacity is (CHOOSE: airspace / interstitial) disease.

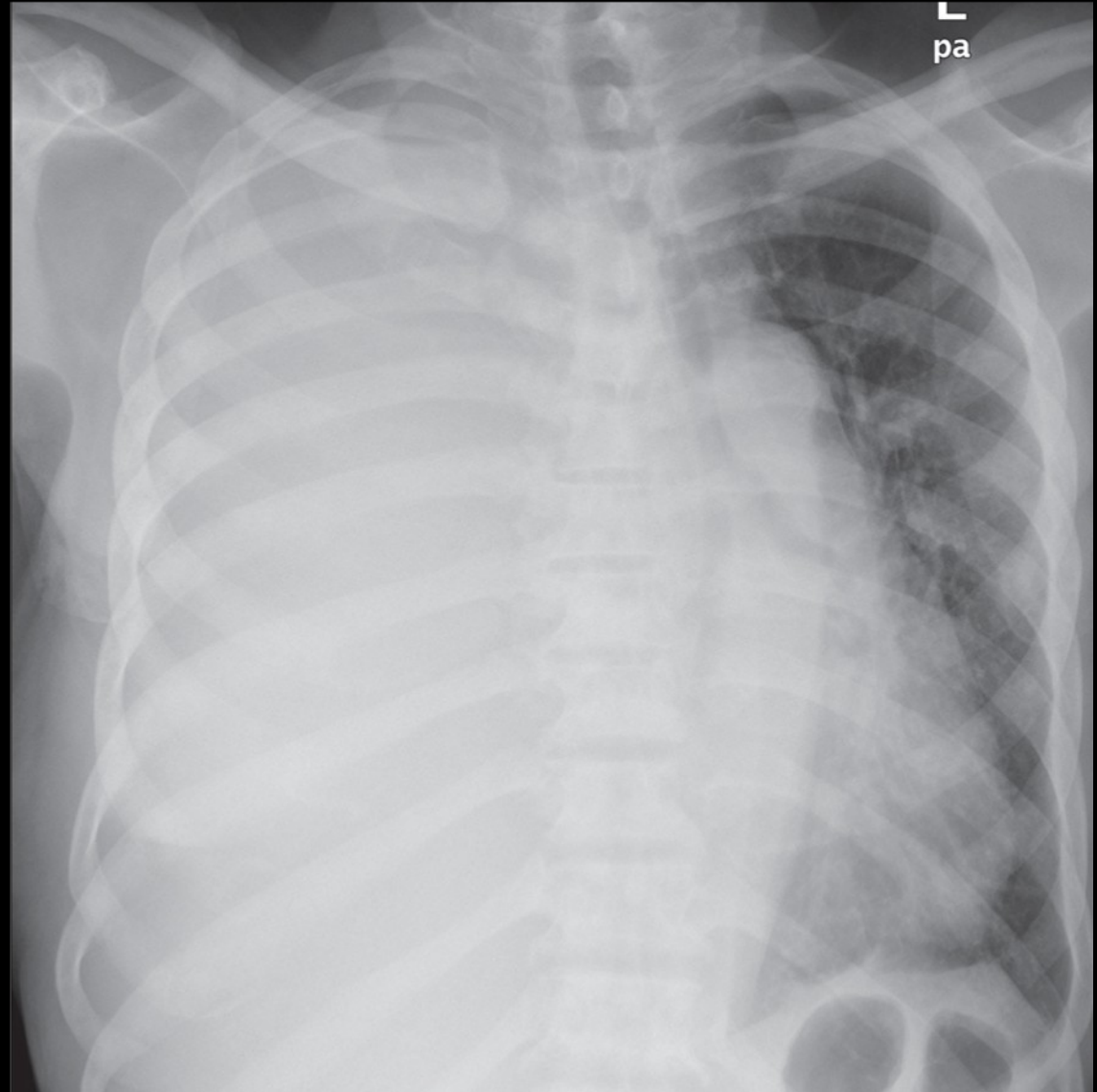
Please choose a answer for both sets of parentheses



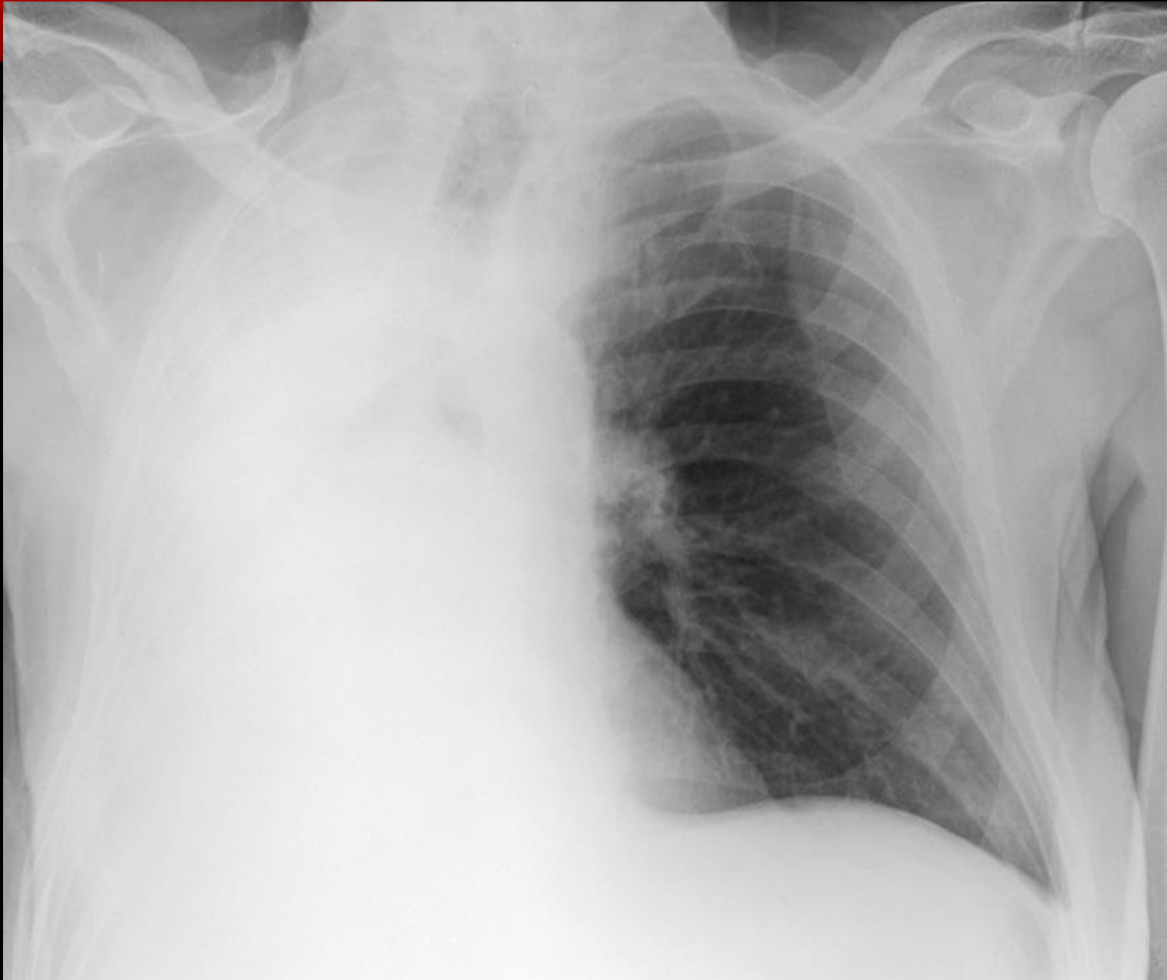
# IMAGE QUESTION 4

This white-out right hemithorax could result from pleural effusion or atelectasis. These possibilities can be distinguished by looking for signs of mass effect.

Is this white-out from **pleural effusion** or **atelectasis**?







## IMAGE QUESTION 5

This white-out right hemithorax could result from pleural effusion or atelectasis. These possibilities can be distinguished by looking for signs of mass effect.

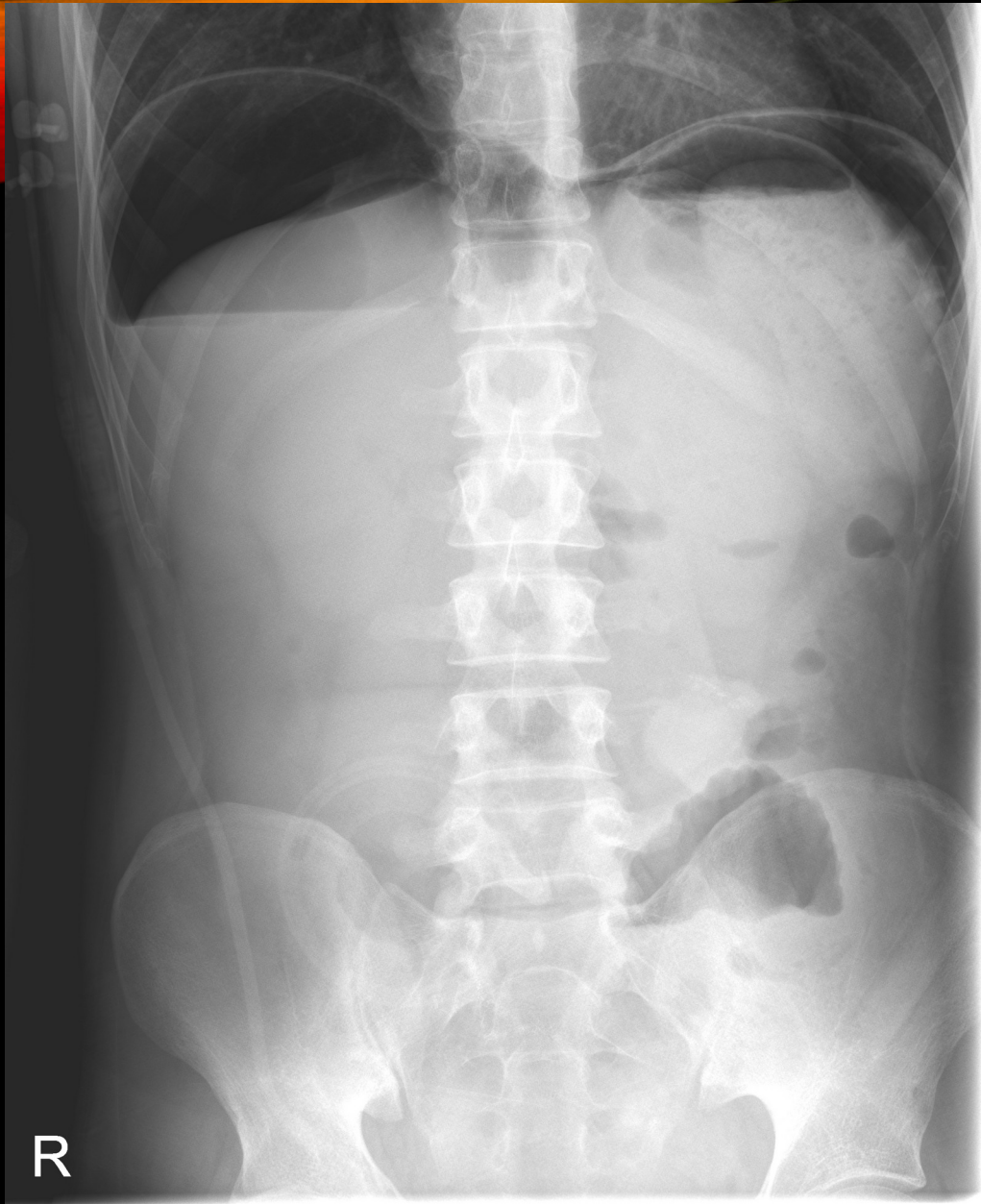
Is this white-out from **pleural effusion** or **atelectasis**?

# IMAGE QUESTION 6

This CT shows bilateral airspace disease, predominating in the dependent aspect of both lungs. The clinical picture is consistent with pneumonia. What kind of pneumonia would be favored, based on the distribution of disease?

CHOOSE: aspiration / tuberculosis / influenza





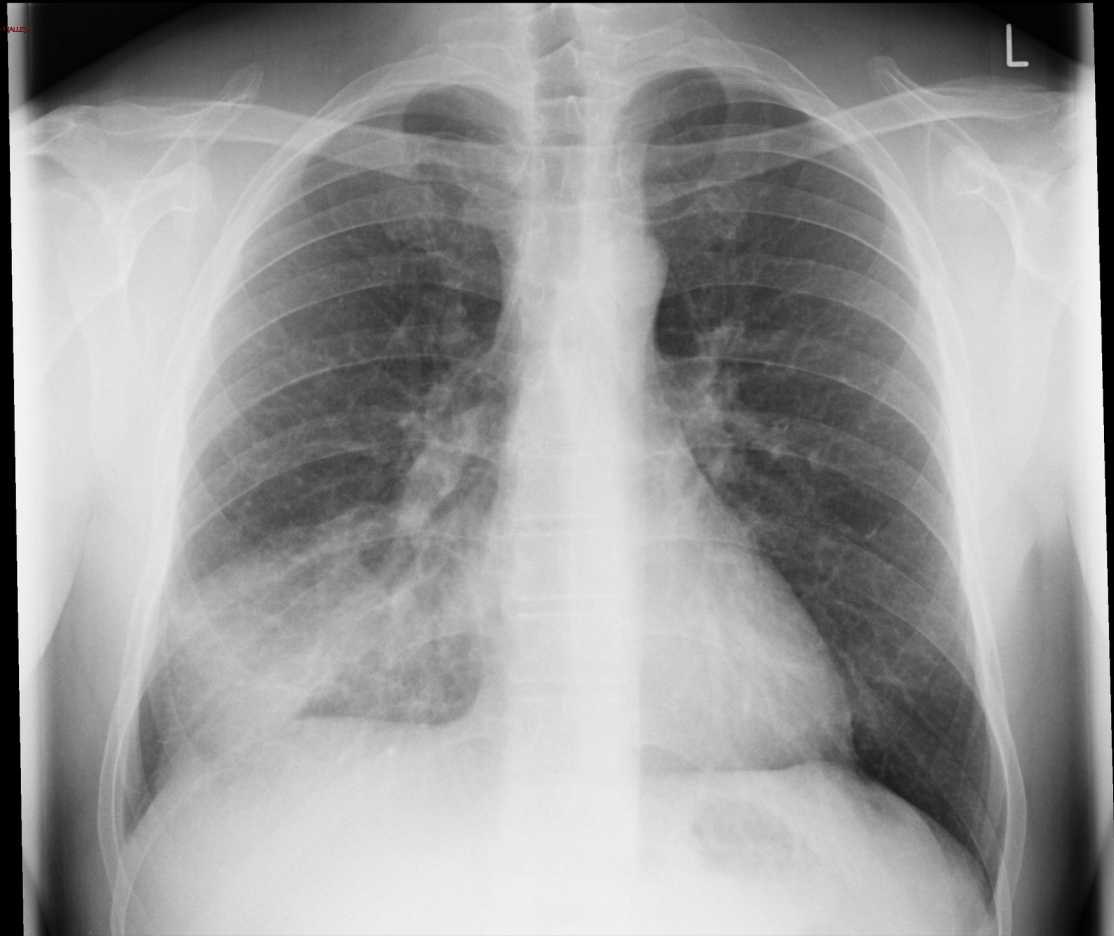
## IMAGE QUESTION 7

This abdominal radiograph shows a surgical emergency. What is the emergent finding?



# IMAGE QUESTION 8

The clinical history is fever and productive cough. What is the diagnosis?







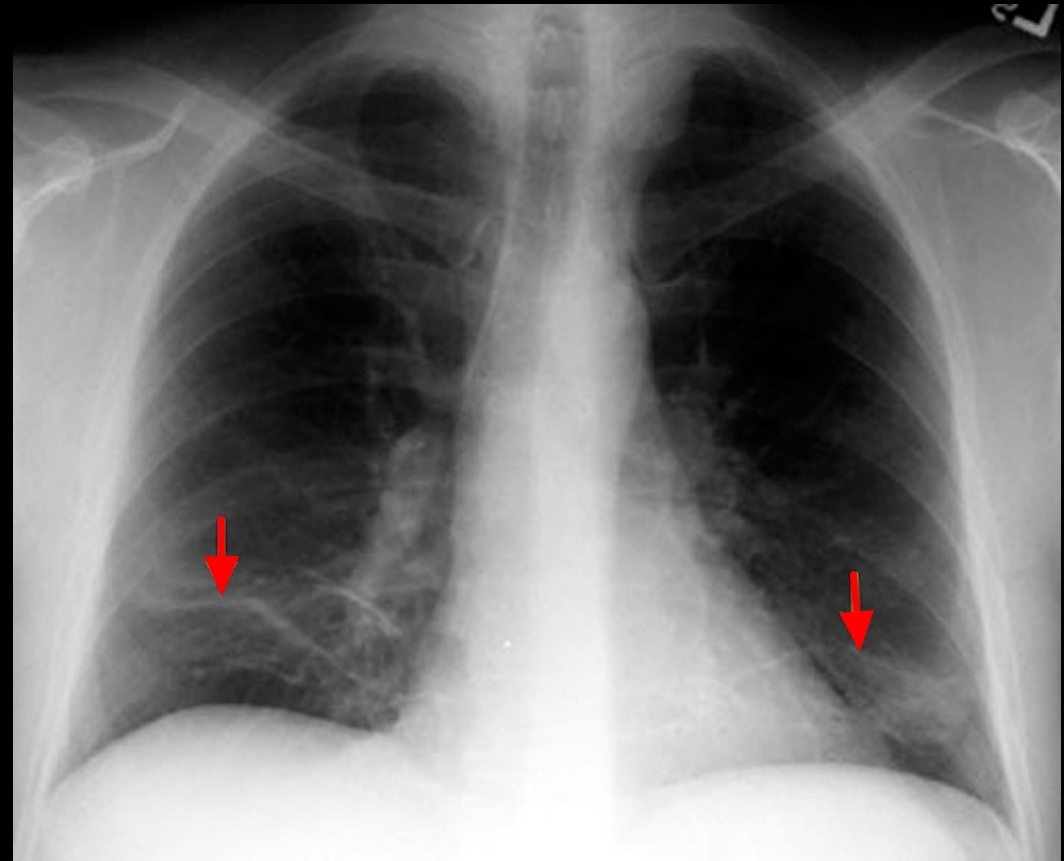
## IMAGE QUESTION 9

What diagnosis explains the patient's abdominal pain?

CHOOSE: ileus / small bowel obstruction / large bowel obstruction / perforation

# IMAGE QUESTION 10

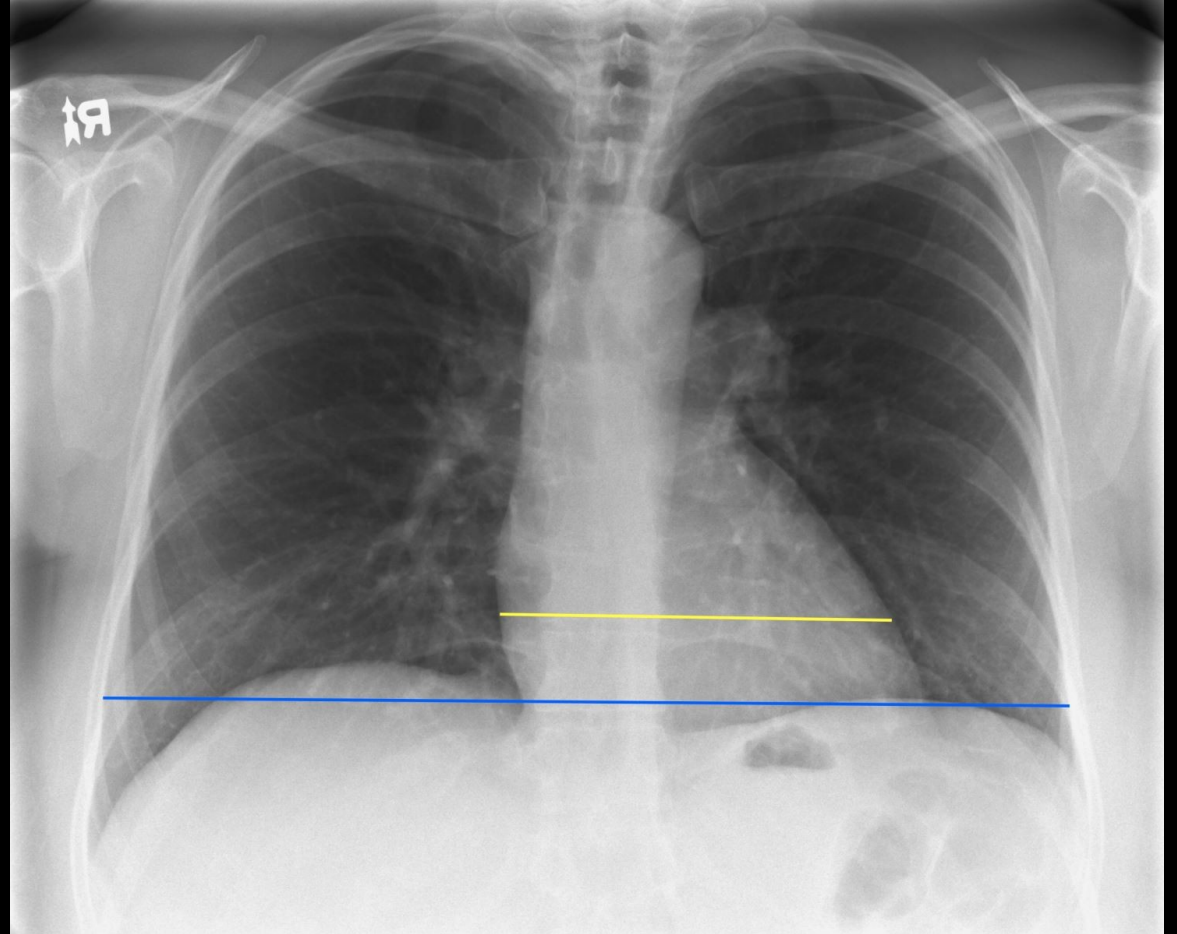
The arrows indicate a common radiographic opacity. It is often described as linear, or discoid, or subsegmental. What term describes such opacities, representing collapsed airless alveoli?



# MULTIPLE CHOICE #1

To estimate whether cardiomegaly is present, the ratio of the maximum transverse dimension of the heart and the maximum transverse dimension of the thorax can be obtained. On a PA radiograph of a normal patient, what is the maximum permissible cardiothoracic ratio?

- a) 20%
- b) 50%
- c) 75%
- d) 85%

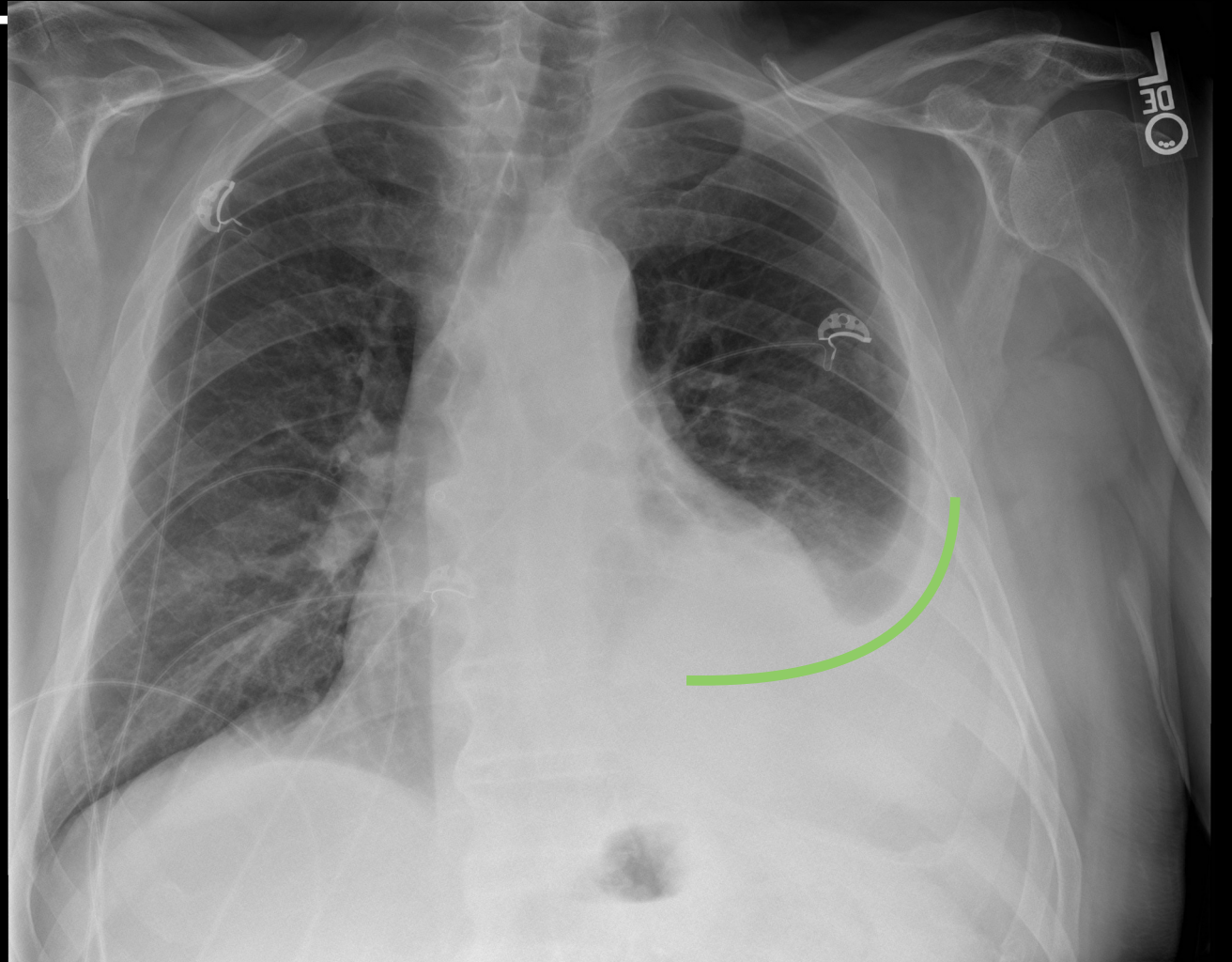




# MULTIPLE CHOICE #2

The **meniscus sign** is a reliable indicator of what kind of opacity?

- a) Consolidation
- b) Pleural effusion
- c) Fibrosis
- d) Pneumothorax





# MULTIPLE CHOICE #3

In an intubated ICU patient, which type of chest radiograph is feasible?

- a) AP chest
- b) PA/Lat chest

# MULTIPLE CHOICE #4

On ultrasound imaging, which of the following would be expected to be anechoic (black) on the ultrasound image?

- a) Air-filled bowel
- b) Renal stone
- c) Normal bladder contents
- d) Lipoma

# MULTIPLE CHOICE #5

What type of pulmonary opacity is most commonly observed on CT in COVID-19 patients?

- a) Ground glass opacity
- b) Consolidation
- c) Spiculated mass
- d) Calcification



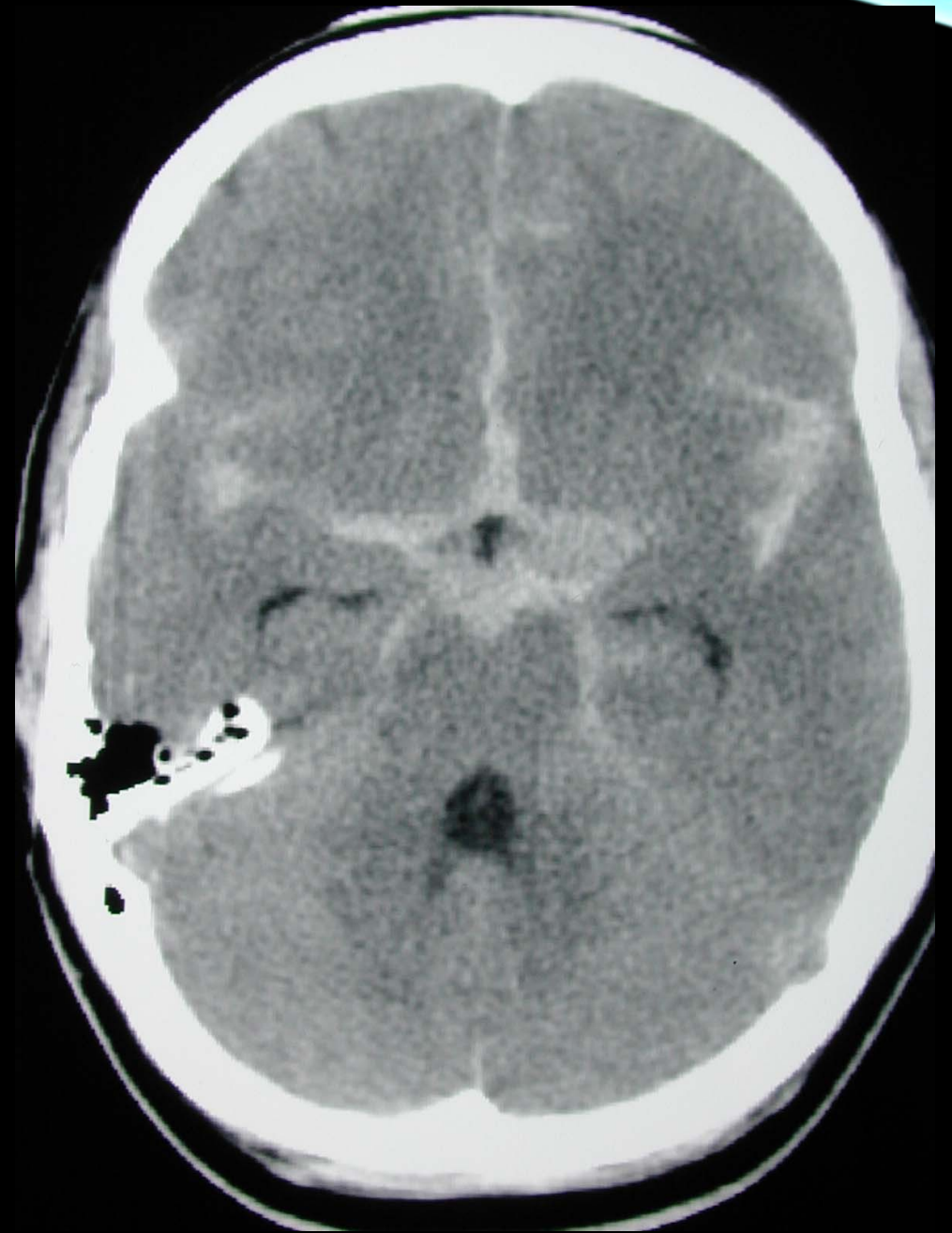
# IMAGE QUESTION 1

What is the diagnosis?



## IMAGE QUESTION 2

This CT shows acute intracranial hemorrhage. In what space is the blood?



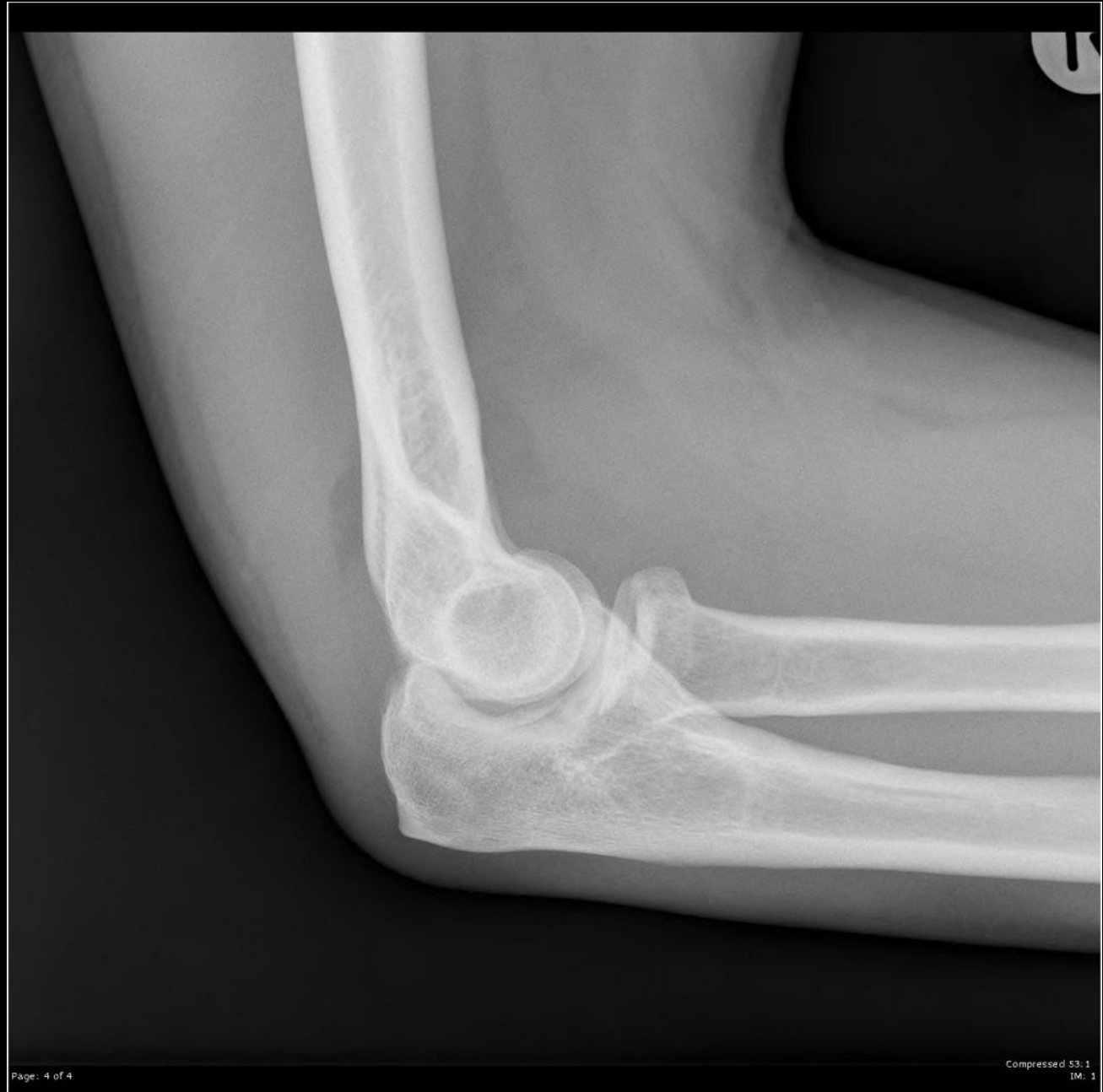
## IMAGE QUESTION 3

In what compartment is the hemorrhage for this patient?



# IMAGE QUESTION 4

History: Trauma. List your findings.





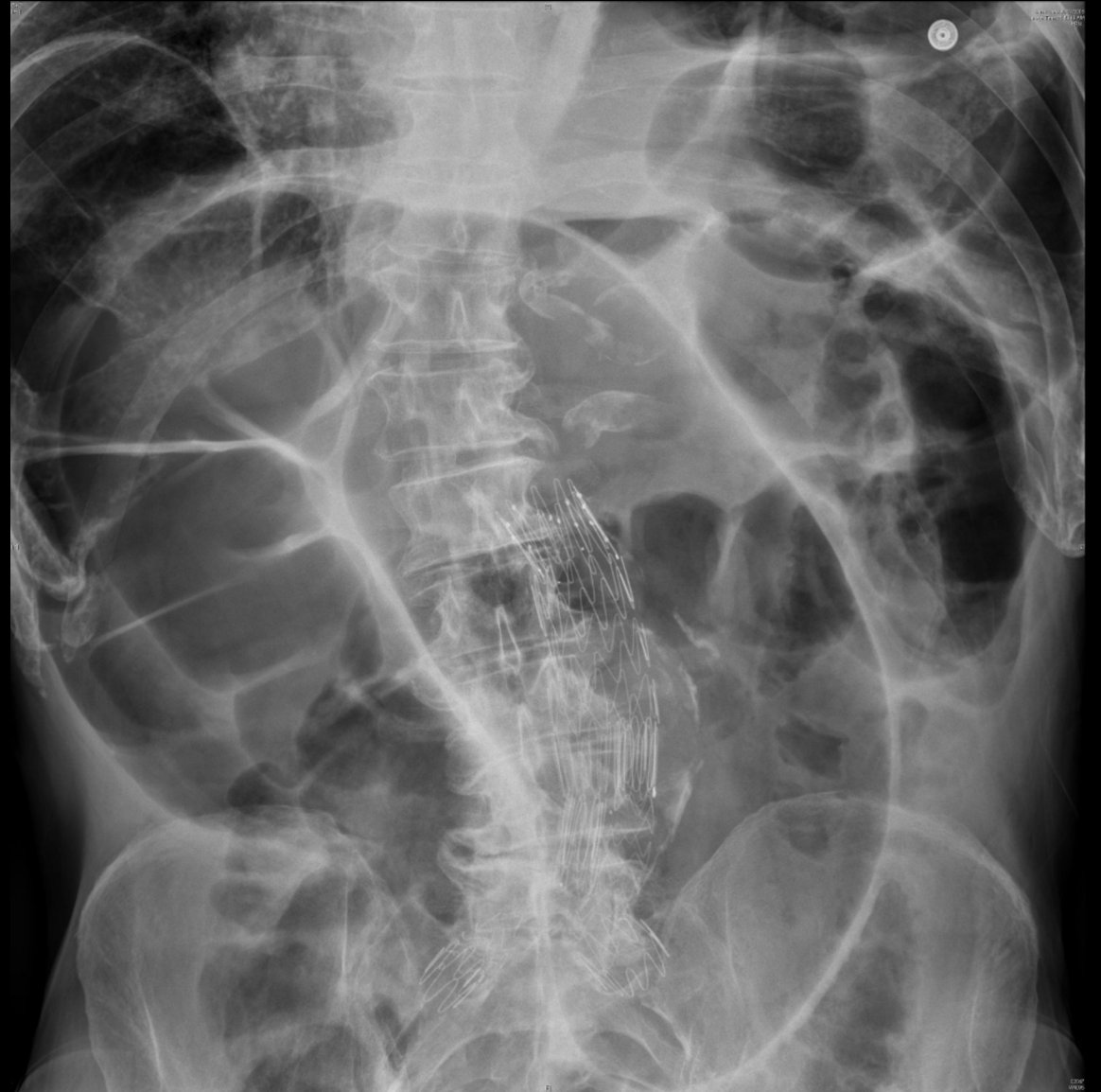
# IMAGE QUESTION 5

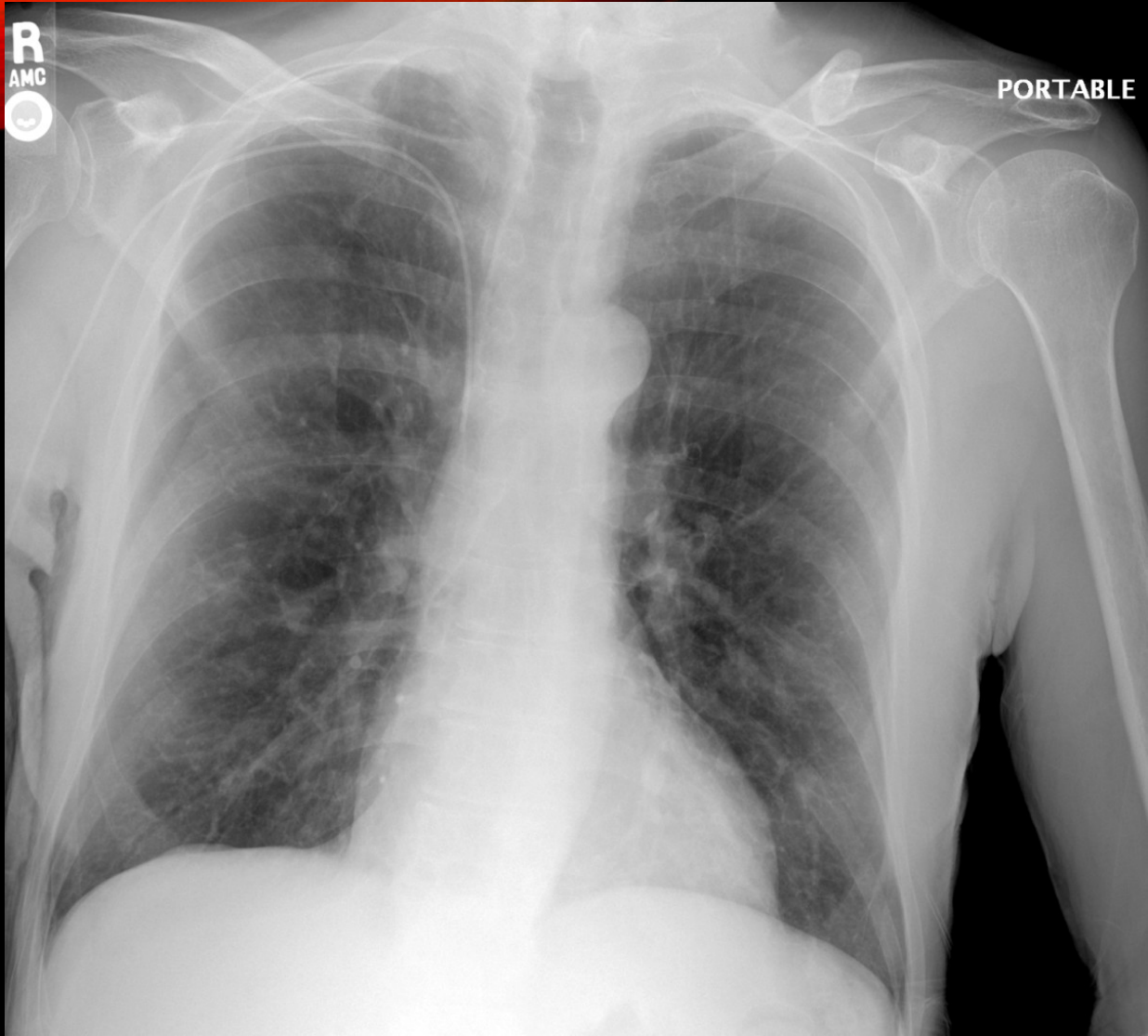
What acute pathology is present?



# IMAGE QUESTION 6

What is the diagnosis? Be as specific as possible.





## IMAGE QUESTION 7

What line/tube is present?

Is it positioned appropriately?

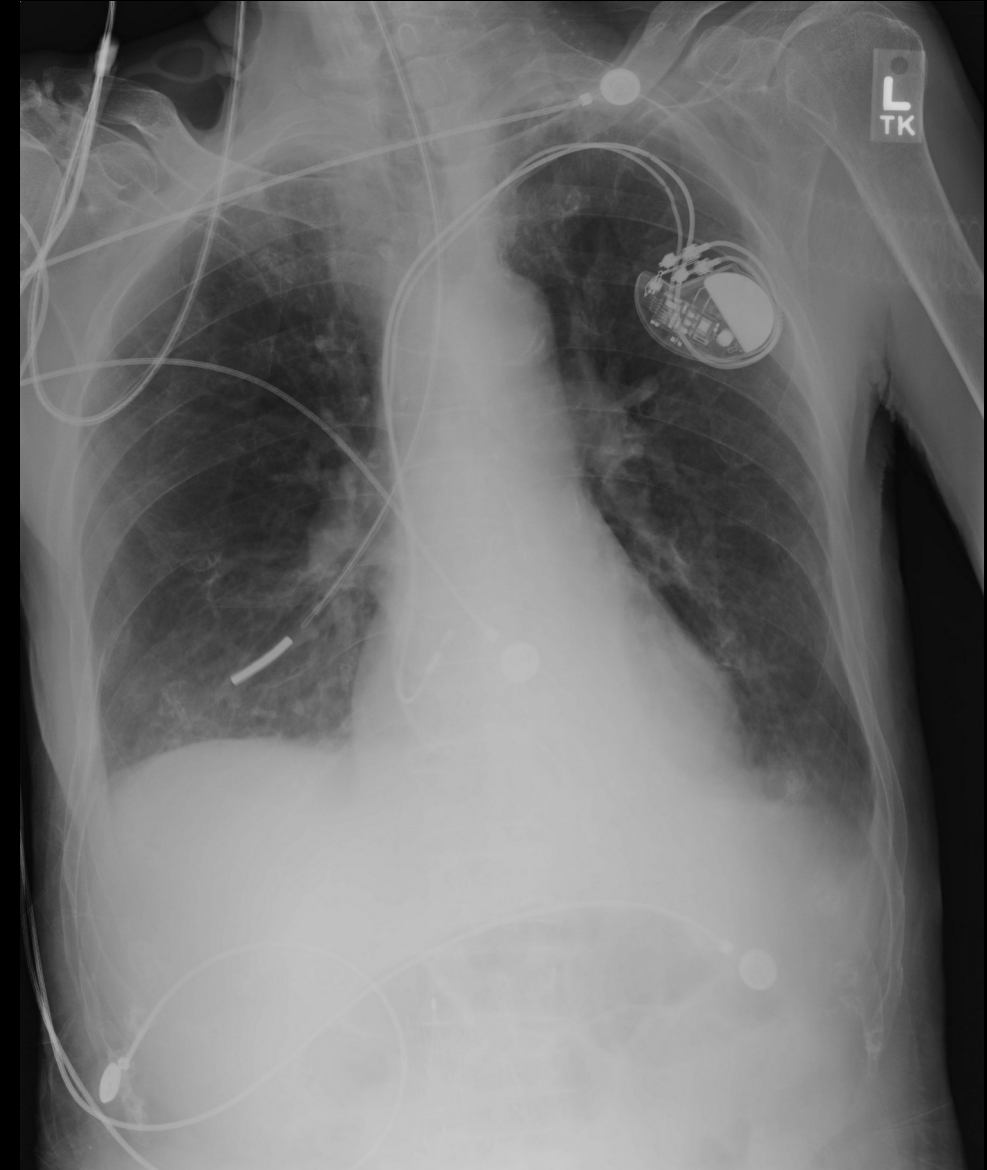
Where is it positioned?

# IMAGE QUESTION 8

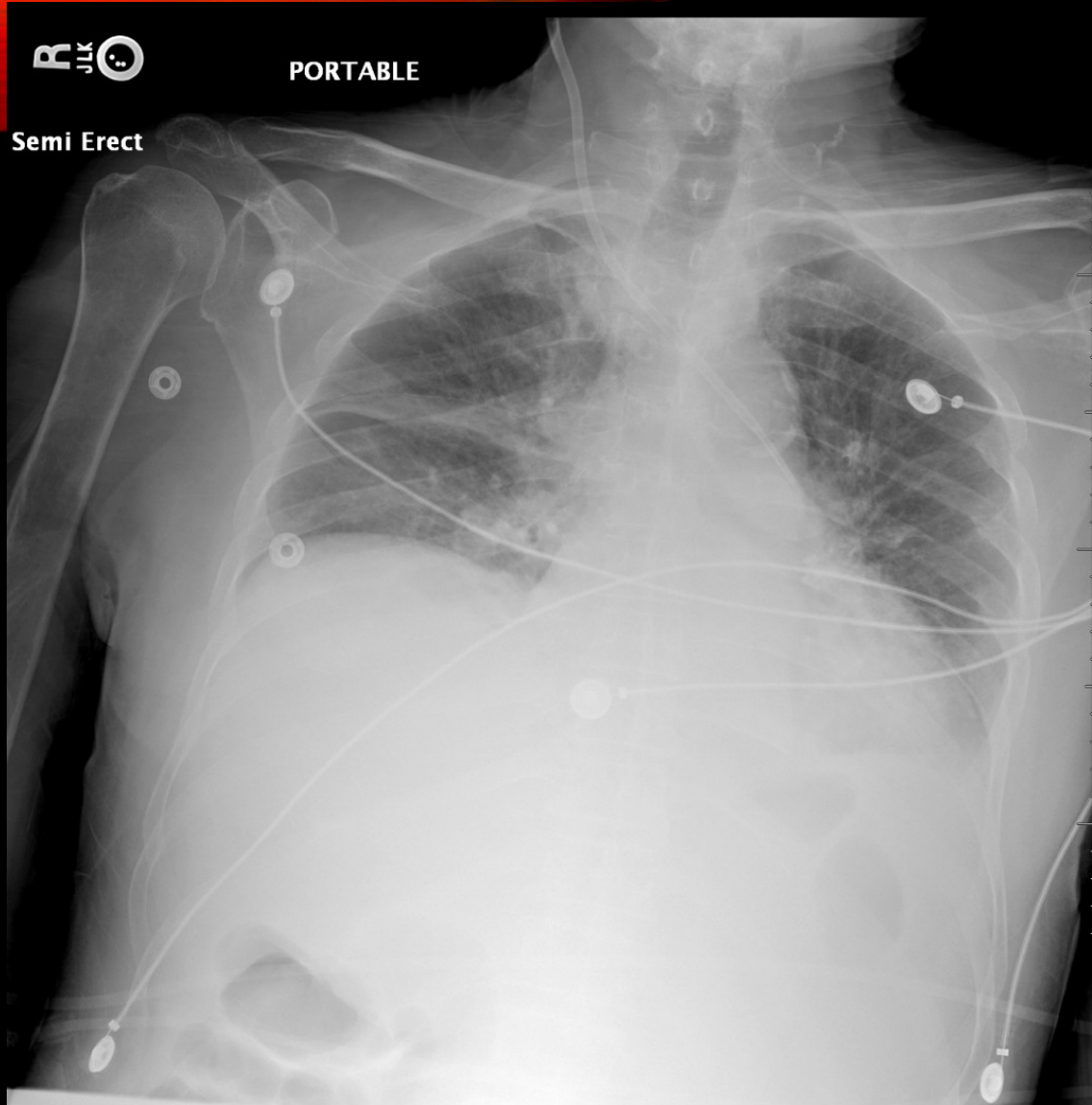
What line/tube is present?

Is it positioned appropriately?

Where is it positioned?







## IMAGE QUESTION 9

What line/tube is present?

Is it positioned appropriately?

Where is it positioned?



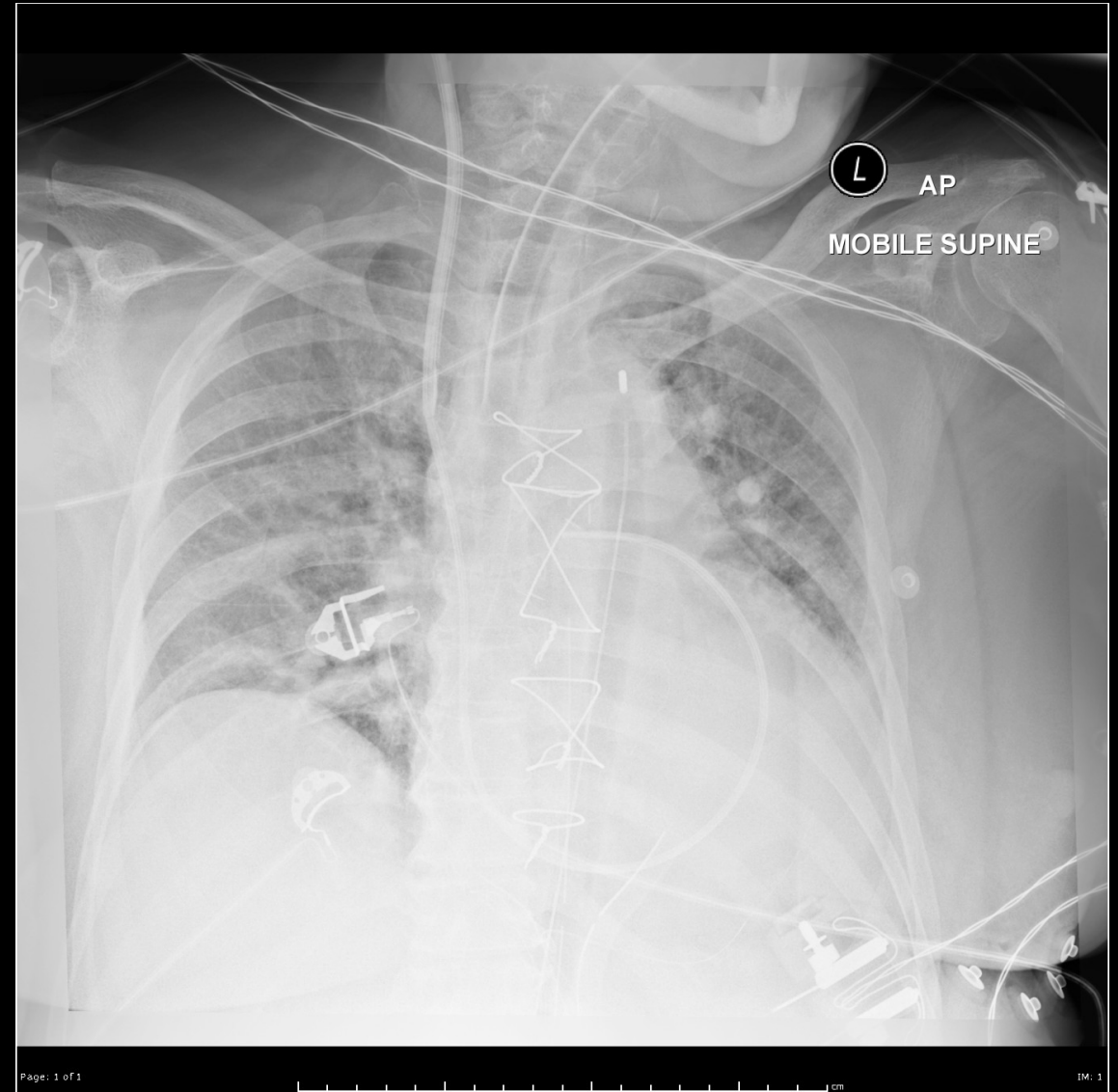
# IMAGE QUESTION 10

What lines/tubes are present?

Where are they positioned?

\*Ignore the monitor leads

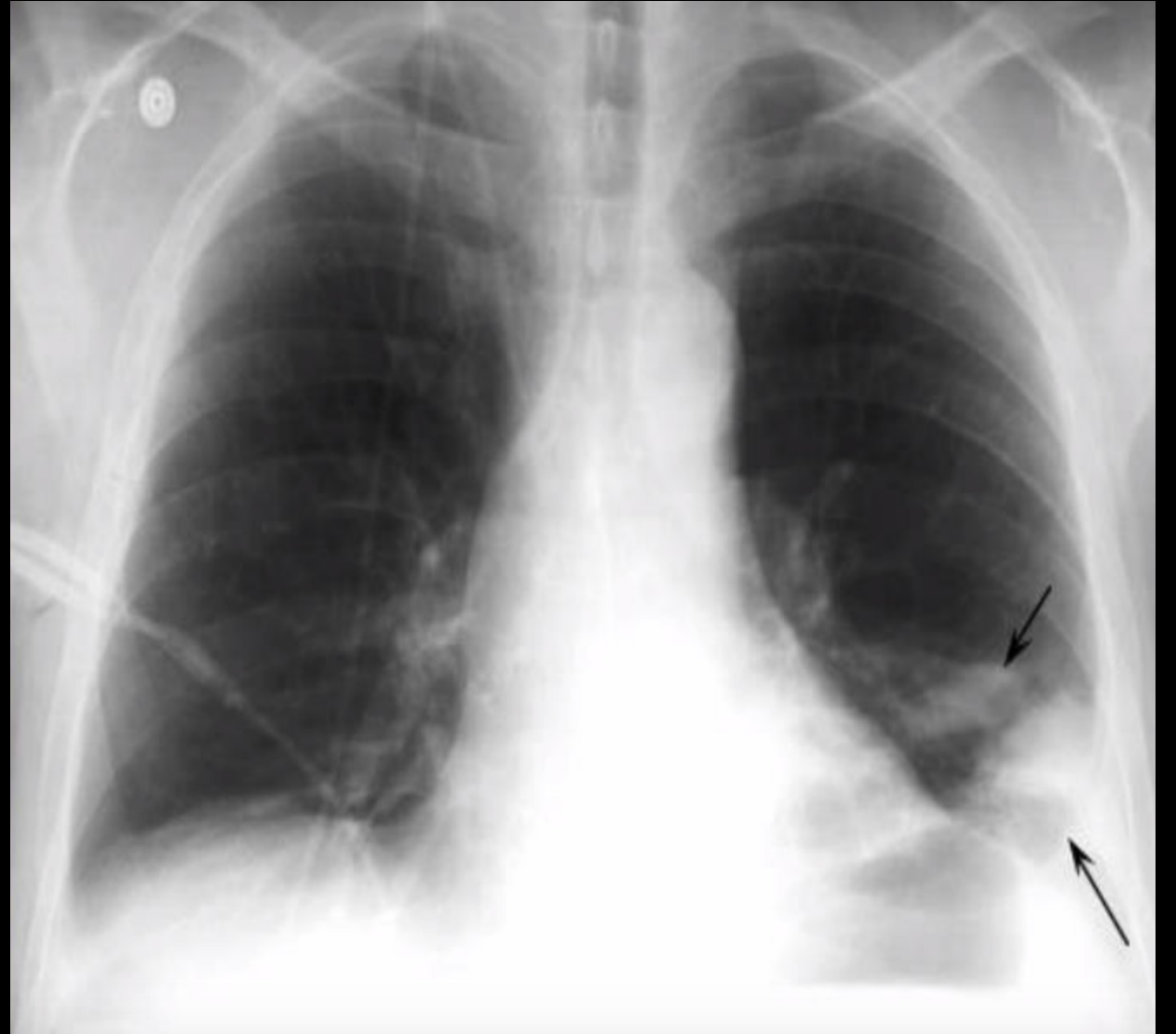
\*There are 3 lines/tubes to find



# CONCEPT QUESTION #1

Hampton's hump, a peripheral often wedge-shaped opacity is a characteristic radiographic finding that accompanies pulmonary embolism.

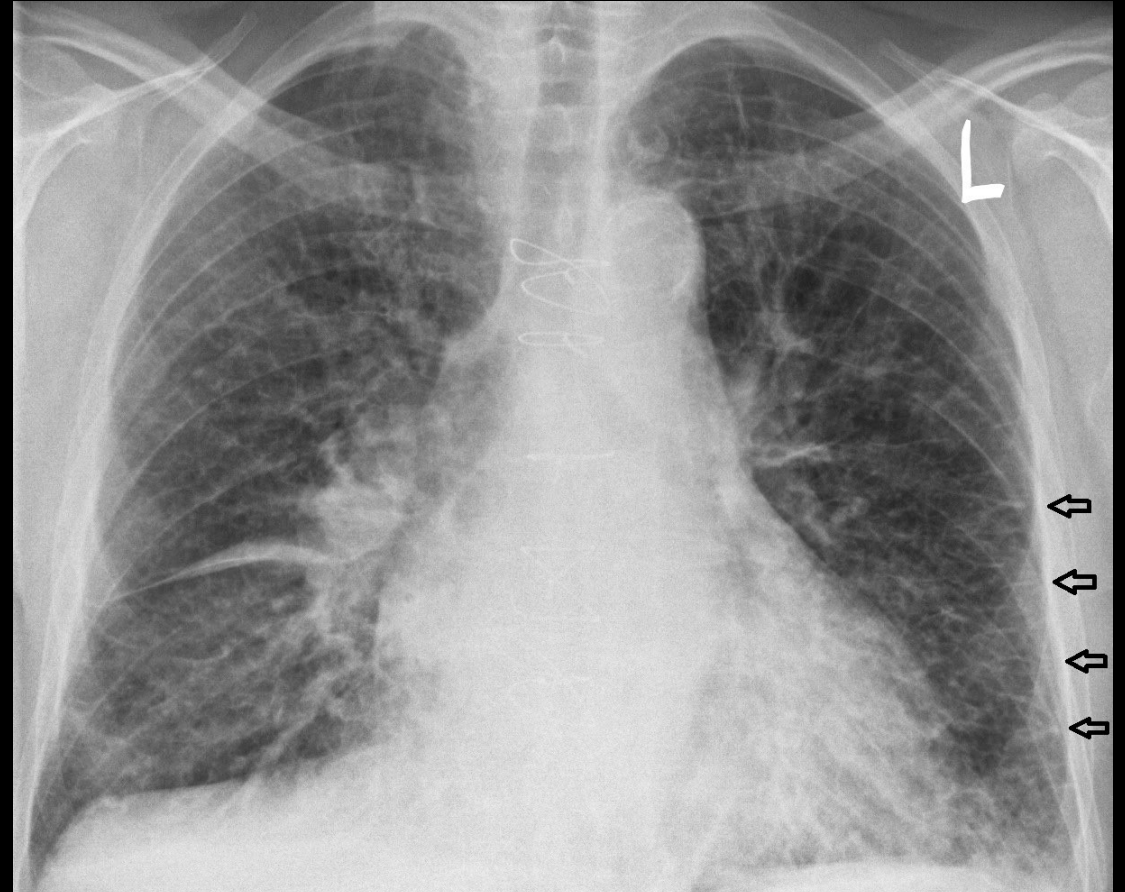
What is the underlying pathologic cause of Hampton's hump?



## CONCEPT QUESTION #2

Kerley B lines describe horizontal lines in the peripheral lung zones, seen in the setting of interstitial pulmonary edema.

What structure accounts for the horizontal lines?



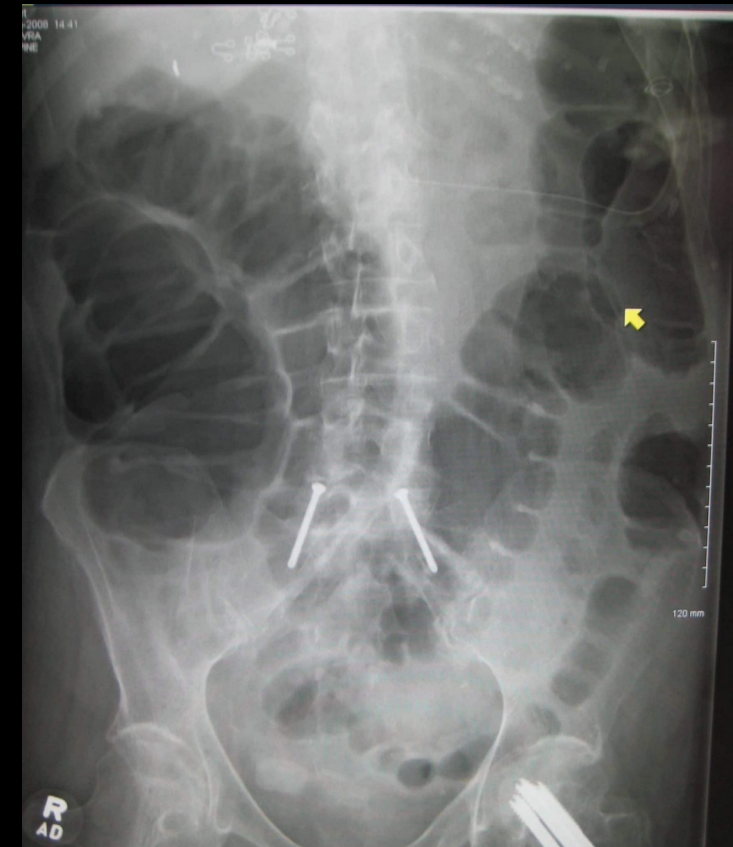
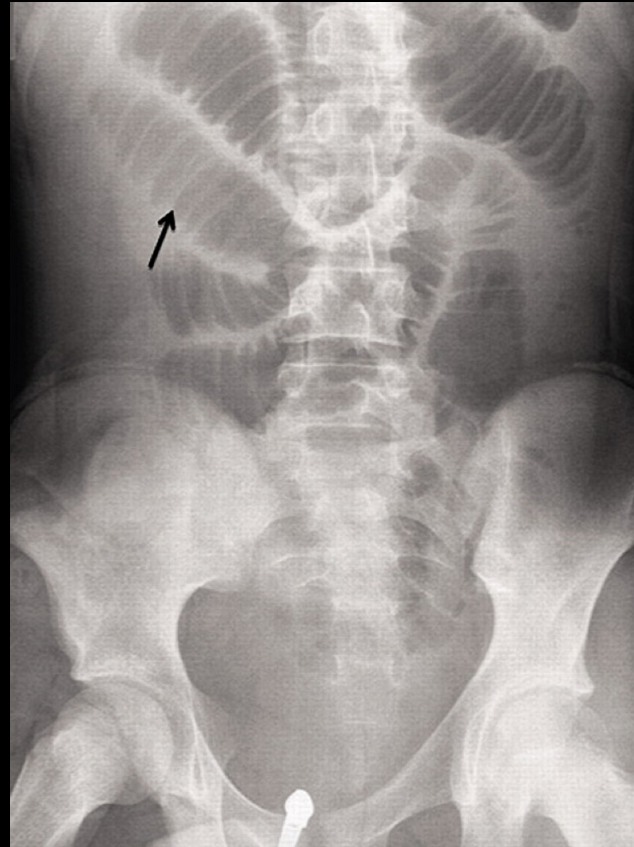


## CONCEPT QUESTION #3

Small and large bowel loops can be distinguished by their mucosal folds. In the small bowel, they are closely spaced and extend across the entire lumen. In the large bowel, they are spaced further apart and are only rarely seen crossing the entire lumen.

What are the folds called in the small bowel?

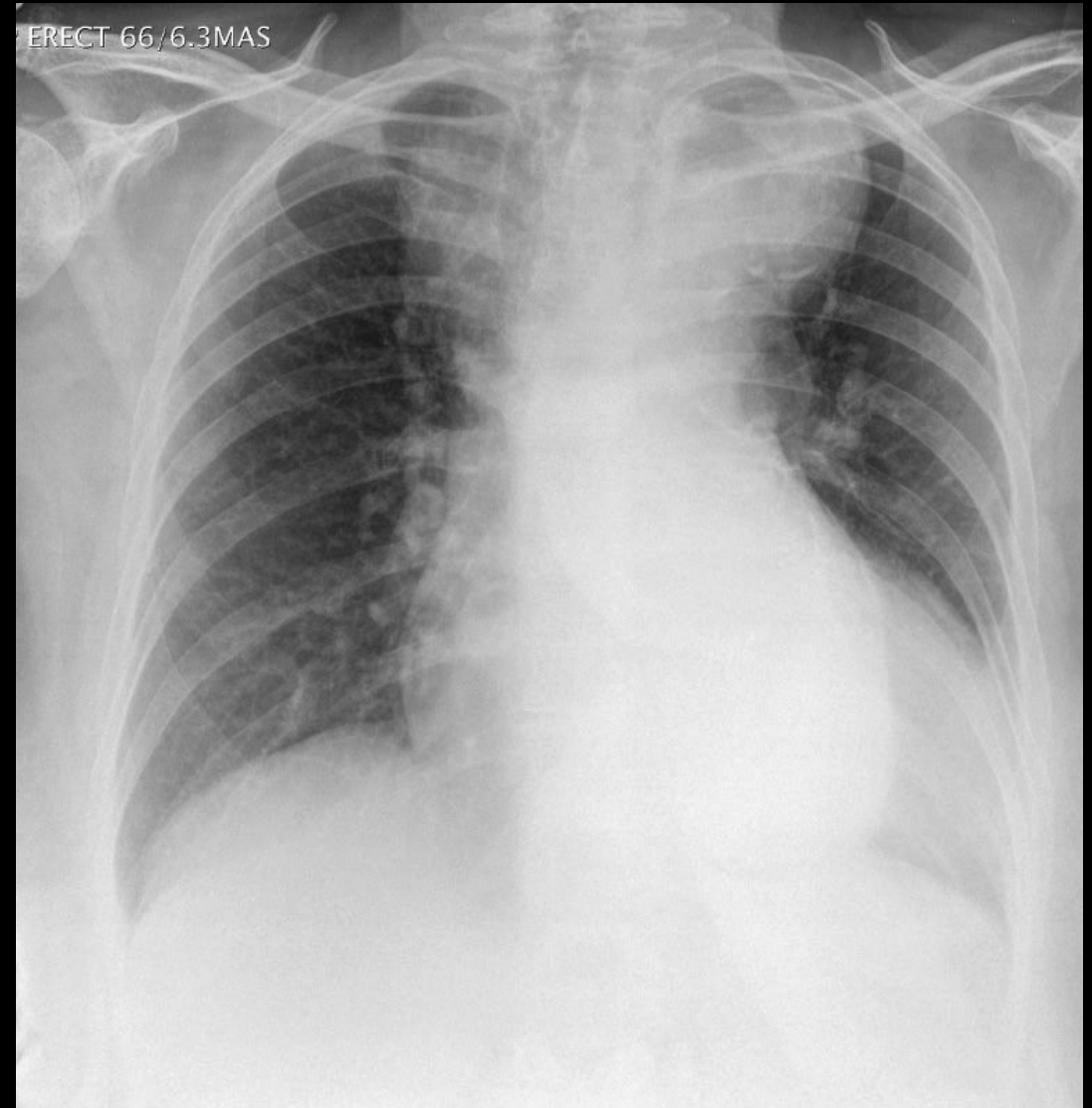
What are the folds called in the large bowel?





## CONCEPT QUESTION #4

In a trauma patient, what is the immediate concern based on this radiograph?



# CONCEPT QUESTION #5

Multiple nodular ground glass opacities are seen in a patient with flu-like illness. In the worst cases, this disease can progress to ARDS.

What community-spread disease must be considered?

